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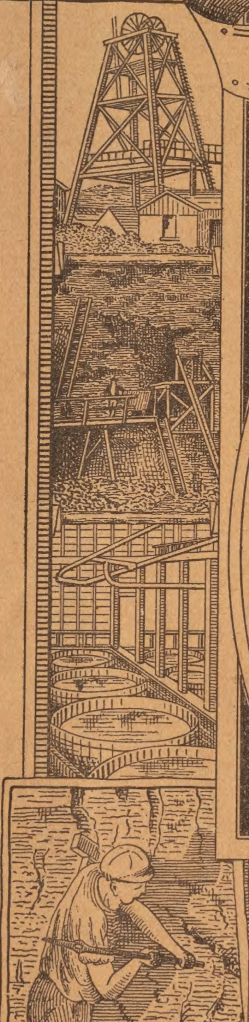
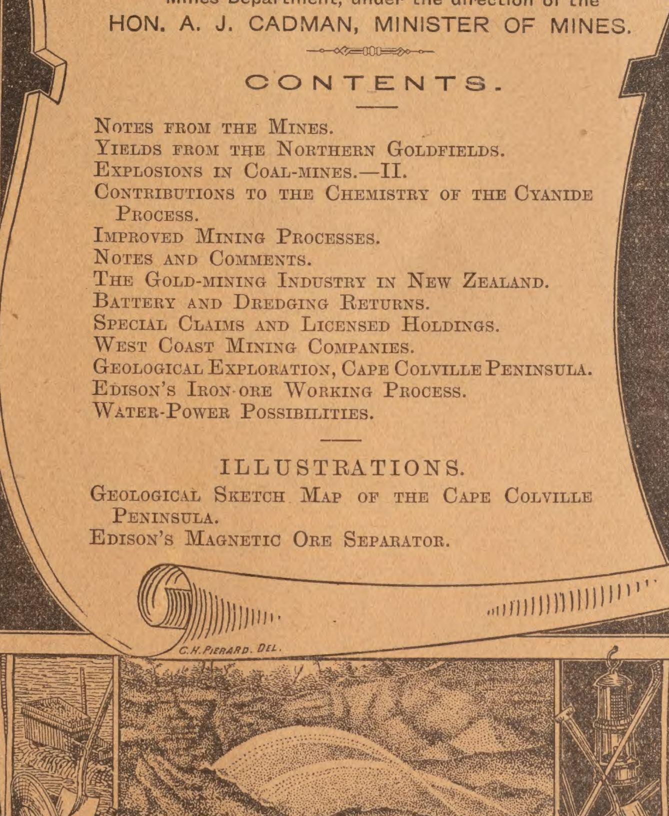
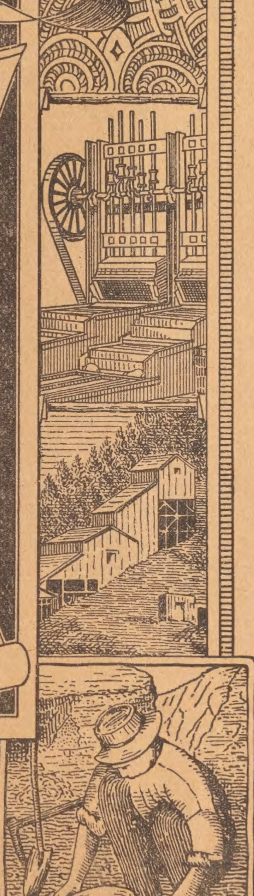
C.H. PIERARD. DEL.







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THE

The New Zealand Mines Record.

Vol. I. JANUARY 17, 1898. No. 6.

NOTES FROM THE MINES.

HAURAKI GOLDFIELDS.

Coromandel.

Golden Shore.—This claim consists of an area of 137 acres, situated on the foreshore at Preece's Point. Ten men are employed sinking a shaft on the beach a little below high-water mark, and are down a depth of 74 ft. It is intended to sink to a depth of 85 ft., and open out at 75 ft., keeping 10 ft. for the well-hole. The shaft was started the intended full dimensions, which are 16 ft. by 6 ft. in the clear, and carried down that size to solid ground, a depth of 12 ft., when it was reduced to 6 ft. by 4 ft., with the view of intersecting the reef and proving it at the depth that it is proposed to cut it. This reef crops out on the surface, on the beach close to the shaft, and appears to be a good-sized body of stone. It was worked a little on the beach, and some stone taken from it showed nice dabs of gold, but the rise of the tide interfered with prospecting work on it on the surface. From the appearance of the outcrop on the surface, the reef appears to be running north and south. They expect to cut the reef in about 30 ft. of driving from the shaft, and it is intended to take the shaft down the full size if the prospects warrant it when the reef is cut at this level. They are at present working with a small vertical boiler and Tangye pump, the mullock being lifted by windlass.

Kathleen Crown.—This company have twenty-five men employed underground and six men on the surface. The principal work in the mine is driving on the Argall Reef, which averages 1 ft. in width, and gives good assay returns. Driving on the No. 1 reef—which runs north and south, averages 18 in., and shows a little gold in the stone occasionally—is being pushed ahead. They are also rising on this reef from the bottom level to an adit level which connects with the shaft, for the purpose of ventilation, and are up 160 ft., only about 10 ft. more being required to hole through. This will improve the ventilation, which is rather defective in portions of the mine. The shaft, which is 11 ft. by 7 ft. in the clear, is down to a depth of 200 ft. On the northern end of the property six men are driving on the No. 2 reef, which averages about 15 in., and shows a little gold in the stone sometimes.

Hauraki.—There are ninety-four men employed by this company in connection with the mine, surface, battery, and Union Beach shaft. Driving, stoping, and rising operations are being carried on in the different levels from the 300 ft. up to the adit-level, where some fair quality ore is being got out of the No. 2 leader, and also from the No. 1 leader, which is about 4 in. in width, the best stone coming from these two leaders at present. The Iona Reef, which averages about 1 ft. in width, is also being operated upon, all the ore broken from it being sent to the battery. Several other reefs and lodes are worked with more or less success. The main shaft, which is 11 ft. by 7 ft. in the clear, is being sunk for another level from the 300 ft. to a depth of 400 ft., at which depth it is intended to open out and prove the reefs. The shaft has attained a depth of 33 ft. below the 300 ft. chamber, in a strong class of country, making a good deal of water. Solid concrete foundations have been laid down, and a very complete pumping and winding plant erected on the site where the plant and wooden foundations were burnt down some time ago. In the Union Beach shaft all the water has been pumped out to below the low-level chamber with two Tangye pumps, and a column to work a plunger-pump has been fixed up. All the necessary machinery for both pumping and winding has been erected, and when the new pump is running operations will be started in the mine. The following are the battery returns for the past six months:—

	No. of Tons crushed.	Picked Specimens.	Yield of Bullion.		
		Lb.	Oz.	dwt.	gr.
July	350	434	1,044	15	0
August	357	121	549	0	0
September ..	304	312	558	0	0
October	350	354	617	14	0
November ..	280	175	552	0	0
December ..	255	298	525	0	0

Hauraki South.—This company, who employ fifteen men, are proceeding with the sinking of their main shaft, which has attained a depth of 130 ft., and is 13 ft. 8 in. by 6 ft. in the clear, worked by a Worthington pump and steam-winch. It is intended to sink the shaft to a depth of 200 ft. before opening out, and it is expected that several reefs which traverse the property will be intersected at that depth, as a considerable amount of driving has been done on this ground on several reefs and leaders above the shaft-level. A parcel of 10 tons treated at the Thames recently gave a return of 9 oz. 5 dwt. of melted gold; 5 tons were taken from the No. 1 leader and 5 tons from the Magazine reef. The shaft is passing through a very good class of country at the present time.

Hauraki North.—Seventeen men are employed in the mine and battery. No. 1 level has been driven 144 ft. along the reef, which is about 2 ft. in width, and shows a little gold. No. 2, or 150 ft. level, has been driven a distance of 308 ft. from the shaft: it is on the same reef as the No. 1 level, there being a block of 50 ft. between the levels. A rise has been put up from No. 2 a distance of 47 ft. with the intention of connecting with No. 1 level, which requires to be extended a distance of 58 ft. to connect with the point where the rise would come through. The work is going on as fast as possible, and when completed will secure ventilation, which is rather defective at times through the workings.

Welcome Find.—Driving and stoping are proceeding on the southern lode, which only averages about 4 in., and they are also driving on the No. 2 reef, which is about 6 in. wide, all the stone broken down from these two lodes being saved for treatment. The low-level cross-cut, which is being driven in a north-westerly direction, is in a distance of 130 ft., in a rather tight class of country. Several reefs and leaders of various sizes have been cut in the different workings, but so far the larger bodies of stone do not appear to be of a payable quality. Fifty-eight tons of quartz and some picked stone sent to the Thames for treatment yielded satisfactorily. Fifteen men are employed.

Golconda.—Eight men are employed by this company in prospecting and development work. They are putting a rise through from the low-level to the No. 1 on the leader, with the double object of providing ventilation and proving the leader between the levels. A steam-winch has been lately put in position on the shaft, and is supplied with steam from the boiler that works the Tangye pump. The shaft, which is 11 ft. 6 in. by 4 ft. in the clear, is down to a depth of 145 ft. Several reefs and leaders have been cut at various distances, but have not proved of a payable nature so far.

Bunker's Hill.—There are ten men employed in this mine. The principal work is driving on a cross leader, which averages 3 in. and runs south-west from bottom of winze in the No. 1 level, all the stone being saved from it. They are also driving the north-east cross-cut to intersect a reef that has been cut in the bottom level, and starting to rise on the Legge Reef from the No. 1 level, the stone obtained at present not being considered payable.

Blagrove's Freehold.—This company have thirty-eight men employed, the principal work done being in the eastern section of the ground, where a small shaft has been sunk to a depth of 125 ft. The No. 1 leader, on which they are driving, stoping, and rising, averages about 6 in. and gives good prospects. Four tons treated from this leader gave a return of 32 oz. of gold. In the main shaft, which is worked by a steam-winch, six men are employed driving from the main cross-cut at the 200 ft. level to connect with the eastern shaft. The main cross-cut is in a distance of 540 ft., and there is still 120 ft. to be driven south to make the connection between the two shafts. A considerable amount of work has been done on the No. 2 reef, which averages 20 in., and fair prospects have been obtained at times.

Kapanga.—Seventy men are employed in and about this mine, including about thirty tributers, who are working from the 420 ft. level upwards, and who lately discovered some very good patches in the different levels. The principal operations of the company are confined to driving at the 1,000 ft. level; they have accomplished 820 ft., and expect to cut the Kapanga Reef at any time. They are also driving on the Hartridge Reef at the 940 ft. level, and work is progressing on the reefs in the 900 ft., 400 ft., and 300 ft. levels. Boring operations with the diamond drill have been suspended. The bore-hole attained a depth of 240 ft. from the bottom of the 1,000 ft. shaft, but through having at different times to pipe the hole, which was started 6 in. in diameter, while going through rubbly and reefy matter, it was reduced too small to continue it further, the last core taken out being only 2 in. in diameter, and hard country with reefy matter was again struck, giving an assay value of £5 to £6 per ton.

Opitonui and Whangapoua.

Kauri Freehold Gold Estates.—There are twelve men employed on the Murphy's Hill section of the property, six men being engaged in driving the Sea

View level, which is in a distance of 358 ft. in a tight class of country, but nothing of importance has so far been met with in this level. Six men are driving a cross-cut on the eastern side of the hill to intersect the Murphy's Hill Reef, which has been trenched and stripped on the surface for some distance, and varies from 10 ft. to 15 ft. in width: they are in about 300 ft., and expect to cut the reef when 80 ft. more has been driven. In the Owera section there are thirteen men employed driving on the reefs in the different levels. The No. 4 or low-level is in a distance of 900 ft., being nearly all the way on the reef, which averages about 3 ft. 6 in., and a little stoping has been done on it in different places. At No. 3 level six men are driving on the reef, which prospects fairly well, and are in a distance of 730 ft. A winze has been sunk from this level on the reef to the low-level, a distance of 126 ft., providing good ventilation throughout the workings. In the Opitonui section extensive operations are being carried on, about three hundred men being employed at the different works in connection with the mine, a large number being engaged in the construction of a tramline, a distance of five miles, from deep water at Whangapoua Harbour to the mine, for the purpose of bringing machinery on to the ground. It is intended to erect powerful winding and pumping and crushing plants. The pumping and winding machinery will be placed on the present engine-shaft, which is down to a depth of 135 ft., and is 12 ft. 6 in. by 4 ft. 6 in. in the clear, worked by a temporary plant—steam-winch and Tangye pump. They are driving east from the bottom of this shaft to intersect the Lanigan Reef at this depth. This reef has been driven on some distance in the surface low-level, varying from 3 ft. to 6 ft. in width, and they expect shortly to cut it in level from shaft. It is also intended to sink two other shafts and erect machinery on them. The formation of branch tram-lines is being pushed ahead, in order to facilitate the placing of the machinery on the sites of the shafts that have been prepared, all the necessary excavations having been done, and everything in readiness to start sinking. Work will then be proceeded with at a depth on the Maiden and Cornwall Reefs, which have been driven on a considerable distance, their average width being about 6 ft.; also on the Opitonui Reef, which is a large body of ore, being 40 ft. wide in some places. A considerable amount of development work is going on in the different levels on these reefs, which are being driven on and regularly tested, with uniformly good results. Winzes have been put down on the reefs at various places in the different levels to a depth of 50 ft. to 70 ft. to prove their value, with satisfactory results in every instance; but there is too much water below that depth for hand-power to contend with. When fully developed there will be a large quantity of crushing material available, and according to present prospects, and the way the reefs are opening out, the company appear to have a good chance of recouping their very large outlay—at times as much as £5,000 per month having been expended in the various development works in progress on the company's properties, while at present it cannot be much less than £3,000 a month.

Kuaotunu.

Waitaia. — This company have twenty-six men employed—twenty-three underground and three on surface—and are carrying out a large development scheme in the mine to prove the different reefs and open them up at various depths previous to erecting the battery. Hoppers have been placed at low-level, which will connect with ground tramway to battery site, and all the quartz broken up is saved for treatment, it being intended to connect the low-level with the higher workings for the purpose of passing all the ore from the mine to the hoppers. There is a considerable quantity of backs available from low-level to top workings, and the prospects of the mine are considered sufficiently encouraging to justify the extensive works in hand. The No. 5 or low-level is in a distance of 517 ft. They have driven on the reef to the north 155 ft. and south 236 ft.; the reef averages 1 ft. in width, and shows nice dabs of gold in the stone in several places. At the No. 4 level, which is in a distance of 296 ft., the reef has been driven on north 571 ft. and south 204 ft. The average width of the reef on this level, which is the same as they are driving on in the low-level, is only about 4 in. In No. 3, or Barrett's level, the reef has been driven on south 492 ft. No. 4 reef drive is in a distance of 130 ft. on the leader, which is about 6 in. in width, and they are putting up a rise on it to the next level. No. 5 reef drive has been driven north 169 ft. and south 145 ft.; the reef averages 20 in., and prospects fairly well. Another reef, known as the "Blue Face Reef," has also been cut in this level, and fair prospects have been obtained from it. In White's level the reef, which has been driven on 30 ft., averages 1 ft. in width. They are sinking a winze on this reef to the No. 5 reef drive. In the Blue Face drive the reef has been driven on 53 ft., and runs from 16 in. to 18 in.

Irene.—Five men are employed on this company's ground driving south on the Try Fluke Reef from bottom of winze; this has been sunk to a depth of 100 ft. from the top level on the reef, which is from 5 ft. to 6 ft. in width. A good deal of work has been done on this property. The reef has been driven and sunk on in several places, but ore of a payable character has not yet been met with.

Kapai-Vermont.—This company have thirty men employed—eighteen underground, and twelve at battery and on surface. The principal work in the mine is stoping on the Try Fluke Reef from the No. 2 to No. 1 level, selected portions of the reef being sent to the battery. The eastern cross-cut on the hanging-wall of the Try Fluke Reef averages 5 ft. in width. The battery, which is a dry-crushing Otis mill, is kept constantly running, and is putting through about 360 tons per month.

Mariposa.—There are sixty-two men employed by this company—fifty-one in the mine, and eleven at the battery and cyanide plant. The principal work in the Try Fluke section is stoping and rising over the low-level on the Try Fluke Reef; also in driving intermediate and prospecting levels. On the Mariposa section, driving, stoping, and rising operations are proceeding on the Try Fluke Reef, also on the eastern lode, which averages about 2 ft. 6 in. in width, all the stone being sent to the battery from this level. In the Venus section the cross-cut has been driven 600 ft., and the Red Mercury Reef cut, averaging about 1 ft. in width; also the western lode, which is about 9 in., but so far has not proved of much value at this level. The company have decided to sink a shaft for another level, it being intended to open out a chamber in the low-level, close to the reef, and erect pumping and winding machinery, as they expect to have a considerable quantity of water to contend with. The battery is kept running steadily, but the ore put through lately has been of a rather poor quality.

Great Mercury.—This company have sixteen men employed in the mine and battery. Twelve men are driving, stoping, and rising on the reefs at the different levels, which are being opened up with a view of increasing the output of ore from what are regarded as payable portions of the reefs, with a view to further developing the mine. The principal reefs at present operated on are the Try Fluke and Red Mercury, and all the stone broken from these reefs is sent to the battery.

Manaia.

There is very little going on in this part of the field at present, only three parties doing any work on their claims. These are the Golden Hill Extended, Little Minnie, and British Fleet. The Golden Hill is being worked by four tributers (R. Ruffin and party), who have had some fair stone from some of the leads they have worked on. They are now sinking a winze on a small leader from one of the surface levels. In the British Fleet ground two men are driving prospecting levels, but nothing of importance has been discovered yet. At the Little Minnie two men are driving to cut a reef that has been trenched on the surface, about 2 ft. wide, running north-east, and showing a little gold at times in the stone. They are in 105 ft., and expect to cut it in 40 ft. more.

Thames.

Moanataiari.—This company will be ready to start crushing next month with a new 60-head battery. It is intended to adopt wet crushing, concentration, and amalgamation, with the cyanide as an auxiliary for treating the tailings. The Cambria Mine, which for many years added its regular quota to the Thames gold-yield, has been amalgamated with the Moanataiari. The extensive development works carried out during the past year have disclosed several blocks of payable ore, which will keep the battery fully employed. The eastern continuation of the famous Caledonian line of reefs has been lately exploited, with the view of discovering payable ore in that portion of the property.

Thames-Hauraki.—Owing to the non-arrival of portions of the machinery, some delay has arisen in the erection of the extensive pumping machinery at this mine, a description of which was published (with illustrations) in the November issue of the *New Zealand Mines Record.* When the plant is completed the work of deep-sinking will be vigorously proceeded with, but five or six months must elapse before a proper start can be made.

May Queen-Hauraki.—This company purpose going in for deep-sinking as soon as the pumping machinery at the Thames-Hauraki is fairly at work, as all the reefs on their property carried gold down to the deepest levels. Meantime prospecting works are proceeding on an extensive scale in the No. 6 level of the Saxon section, and a payable reef has been discovered. They are also engaged in re-timbering and enlarging the old Queen of the May shaft, from which the low levels are to be worked, and the shaft will be sunk to a further depth after the Thames-Hauraki pumping machinery has got rid of the water. During the past year the company obtained bullion to the value of over £1,600. The last crushing of 382 tons and 162 lb. of picked specimens gave a return of 604 oz. of gold.

New Alburnia.—This mine, which rose from the lowest ranks of bullion-producers in 1896 to the highest in 1897, added £5,548 to the Thames gold-yield for the past year, 3,393 tons treated yielding 2,093 oz. of gold.

Kuranui-Caledonian.—Some extensive development works have been carried out in this property during the past year, a great deal of the ore sent to the battery coming from the various levels, and, although poor in quality, gave a yield of 1,575 oz., valued at £4,206, from 3,226 tons.

Waiotahi.—This is one of the oldest as well as one of the most consistent gold-producers in the Thames Goldfield, but last year there was a considerable falling off. 1,015 tons were crushed for 1,375½ oz. of gold, valued at £3,765, the figures for the preceding year being: 1,613 tons, 2,057 oz. 5 dwt.; and tributers, 261 tons, 342 oz. 4 dwt: total value, £6,538 10s.

Tararu.—This company crushed 2,547 tons of ore and treated 2,845 tons of tailings for bullion valued at £3,327. With the air-compressor to work the rock-drill in the tunnel, the new water-race capable of driving a 40-stamp mill, and various development works, this company should be in a position to materially increase its yields during the present year.

Karangahake.

New Zealand Crown Mines.—This company, whose forty head of stamps have been changed during the past few months from dry to wet crushing, enabling a much larger treatment at the battery, produced bullion to the value of £43,433, and paid a 2s. dividend on 200,000 shares. Under the changed method, ore of a low grade has been put through the battery, which it is stated would not pay for crushing under the dry process; and so satisfied is the superintendent of the mine with the extensive ore-bodies in sight, that preparations are now being made for forty additional stamps to the battery, making eighty in all. The returns for the past six months have been :—

	No. of Tons crushed.	Yield of Bullion.			Value.		
		Oz	dwt.	gr.	£	s.	d.
July ..	1,200	1,865	18	0	3,206	5	10
August ..	1,473	2,352	0	0	4,081	5	11
September	1,567	2,394	0	0	4,163	0	0
October ..	1,788	2,024	3	0	4,068	17	3
November	1,964	2,010	15	0	4,232	7	3
December	2,034	2,038	0	0	4,443	12	4

Woodstock—The experiments in wet crushing at this mine have given as high an extraction as 89 per cent., and it is very likely, in consequence, that the whole of the forty heads will be converted to wet crushing during the next few months. A very rich vein of ore has been met with at the back of the No. 5 level, 2¾ tons dealt with by pan amalgamation at Fraser and Son's Works, Auckland, giving a return of bullion valued at £359. The work done in the mine during the past year has been of a satisfactory nature, tending to establish the permanence of some rich shoots of ore met with in the different levels, while the bullion realised over £30,000. The following are the returns for the past six months :—

	No. of Tons crushed.	Yield of Bullion.			Value.		
		Oz.	dwt.	gr.	£	s.	d.
July ..	1,030	5,696	7	0	3,947	2	0
August ..	1,015	5,417	5	0	2,758	19	5
September ..	1,170	4,081	0	0	3,060	5	6
October ..	1,015	2,970	6	0	2,765	1	2
November ..	1,020	3,157	4	0	3,171	0	0
December ..	1,018	..			3,187	18	7

New Zealand Talisman.—This company have a special claim of 60 acres, comprising the old licensed holdings known as the "Talisman" and "Bonanza." Numerous gold-bearing reefs occur on the property, but mining work is chiefly confined to the Talisman Reef. This reef has been developed by cross-cuts intersecting the ore-body at intervals varying from 70 ft. to 114 ft. Six levels have been driven on the reef, these workings varying in length up to 550 ft., and the reef varying in width from an average of about 3 ft. in the upper to 5 ft. in the lower workings. No. 7 cross-cut, now in progress at a depth of 123 ft. below No. 6, has been driven 320 ft. to date, and should intersect the reef after 437 ft. of further driving. No. 7 cross-cut is 600 ft. above the level of the Waitawheta River, so that an unusually large quantity of backs are available for development by means of adits. Outcrops of gold-bearing reefs have been met with in the Bonanza section of the property, and one of these is believed to be the continuation of the Talisman Reef: payable assays have been obtained from these outcrops. The reduction plant consists of two rock-breakers of Blake type, one revolving ore-drier, ten heads of 850 lb. stamps, ten heads of 1,000 lb. stamps, one No. 5 Krupp ball-mill, two wooden cyanide vats, 16 ft. diameter and 4 ft. deep, twelve wooden cyanide vats, 22 ft. diameter, 4 ft. deep, amalgamating tables, six berdans, and the usual accessories, the machinery being operated by means of two "Victor" turbines. The works and offices are electrically lighted. Up to the present time the whole of the crushing has been done by means of the twenty stamps, but the Krupp mill is to commence running at an early date, and will materially increase the output. The quantity of ore treated up to 12th December, 1897, is 3,498 tons, yielding bullion worth £12,011 3s. 4d., or an average of £3 8s. 8d. per ton. The company's general managers are Messrs. Bewick Moreing and Co., of

London, represented in New Zealand by Mr. W. A. Mercer and Mr. A. H. Curtis, mining engineers.

Waihi.

Waihi.—This company finished the year's operations with a crushing of 4,680 tons, for a yield of 16,673 oz., value £17,111 11s. 6d. The total bullion receipts for the twelve months amounted to £143,291 9s. 2d., as compared with £137,321 for the year 1896. The following are the returns from this mine for a period of eight years :—

	Number of Tons crushed.	Value of Bullion.		
		£	s.	d.
For year 1890		21,112	13	6
1891		23,935	5	11
„ 1892	18,236	44,888	2	4
„ 1893	19,805	61,900	10	11
„ 1894	24,864	82,827	2	2
„ 1895	33,670	120,334	2	2
„ 1896	34,400	137,321	8	2
For year 1897—				
Period ending 6th February	4,140	14,010	14	1
Four weeks ending 6th March	3,120	10,650	11	7
„ „ 3rd April	3,150	10,022	4	11
„ „ 1st May	3,060	9,355	4	9
„ „ 29th May	3,294	11,266	18	1
„ „ 26th June	3,240	11,780	11	7
„ „ 24th July	3,120	11,672	6	6
„ „ 21st August	3,120	11,757	1	10
„ „ 18th September	3,300	12,670	5	4
„ „ 16th October	3,240	11,640	13	6
„ „ 13th November	3,300	11,352	13	4
Five weeks ending 18th December	4,680	17,111	11	6
Total from 1890 to 1897 inclusive		£635,610	14	4

Shareholders have received over one-third of the total production in dividends, the amount actually paid away being £244,500.

Waihi-Silverton Extended.—This mine continues to yield ore of fair quality, the last crushing for the past year of 1,150 tons giving 816 oz. of bullion, value £1,555, the year's total being over £17,000. The following are the returns for the past six months :—

Month.	No. of Tons crushed.	Yield of Bullion. Oz.	Value. £
July	1,000	725	1,399
August	840	556	1,108
September	1,024	622	1,220
October	1,104	820	1,615
November	1,250	856	1,694
December	1,150	816	1,555

Waitekauri.

Waitekauri.—Important works are in progress in this company's properties, and active preparations are being made for the sinking of the shaft at the intermediate level on the Te-ao-Marama section, with the view of establishing a connection with the low-level which is being driven from the Grace Darling Creek. There has been a steady improvement in the bullion returns since the alterations were made at the reduction works, and the large ore-bodies now being developed are sufficient to keep the battery constantly at work. Bullion to the value of nearly £52,000 was produced during the year. The battery returns for the past six months are :—

Month.	No. of Tons crushed.	Yield of Bullion. Oz.	Value.		
			£	s.	d.
July	1,841	4,689	5,462	2	1
August	1,830	3,728	3,900	18	10
September	2,005	2,888	3,050	9	8
October	2,095	4,236	4,512	5	9
November	1,945	3,545	4,077	2	6
December	2,415	4,513	4,859	13	4

Komata.

Komata Reefs. — This company's new battery, which is situated a mile and a half down the Komata Creek from the mine, with which it is connected by tramway, had a second clean-up at the end of the year, 320 tons giving a yield of 200 oz., the first crushing of 1,000 tons giving a return of bullion valued at £3,300. It is stated that the prospects of the mine are considered sufficient to warrant the enlargement of the present battery by twenty additional heads of stamps and six percolation vats.

OTAGO GOLDFIELDS.

Macetown.

Glenrock Consolidated.—This company's operations for the past year have been of a satisfactory character. The total quantity of quartz crushed was 3,848 tons, which yielded 2,824 oz. of gold, valued at £11,926, out of which Mr. Stanford, the manager, was able, after paying all expenses, to remit to the directors in London £2,550. For the last clean-up the yield was 321 oz. 6 dwt. 10 gr. of gold from 480 tons, and 24 tons of concentrates produced gold to the value of £77.

Cromwell.

Up to the holidays none of the dredges on the Kawarau River had recommenced work on the Kawarau since the rise in the river, but McLay's, Kloogh's, and Crookston's had started work on the Clutha. As indicating the value put upon dredging in this district, it may be stated that a twelfth share in McLay's dredge was recently sold for £215. Silk's dredge was reported to be getting small returns, and the Upper Nevis Company's dredge fair returns. Hotop's dredge, at Bowman Flat, will shortly be fitted up with machinery.

The Cromwell tributers have had another good return. They came in three days before Christmas with 384 oz., the result of ten weeks' work. They were following a leader, when they struck a fine body of quartz, about 2½ ft. in width, carrying gold right through the stone.

Naseby.

Good progress has been made with the dredges that are being placed on the Kyeburn, one of them, a small dredge removed from the Fillyburn Creek, near Hyde, having commenced work on the 4th instant, while the other, the property of the Kyeburn Company, will make a start during the month. The completion of Guffie and Company's dredge in the Main Gully has been retarded through the non-arrival of the machinery, portions of which are imported, the delay being due, it is stated, to the engineers' strike in England. The pontoons are already built and floating about.

* * *

EXTRACTS FROM GOLDFIELDS PRESS.

Hauraki Goldfields.

News (Coromandel) : A crushing of 80 lb. of specimen stone from the Bay View has been treated by the Bank of New Zealand for a return of 25 oz. of gold, valued at £65 4s. 2d.

A. Ross and party (Buffalo tributers) have secured 18 lb. of premier picked stone in the Buffalo claim. It has been lodged in the bank.

J. Mallet banked 15 oz. 9 dwt. of gold, the result of prospecting operations in the Tiki district.

The Kapanga tributers, Andrews and Gunn, are still getting some good stone.

Hauraki Tribune (Paeroa) : Mr. Daw, general manager of the New Zealand Crown Mine, is reported to have demonstrated the fact that the bullion ores of Ohinemuri can be successfully treated by wet crushing, and at the present time the whole of the output of the mine is being treated by this process.

New Zealand Herald: The machinery for the Alpha Gold-mining Company, whose property is at Waitekauri, has arrived in Auckland, and will be conveyed to the mine as expeditiously as possible. The battery is being erected for the company by a syndicate, of whom Mr. D. E. Clerk is the representative, the consideration being a proportion of the shares in the company. The battery will be placed in position as soon as possible, and it is anticipated that by the time crushing operations are commenced development work at the mine will have resulted in large blocks of ore being opened up.

By the mail steamer "Mariposa," which arrived from San Francisco on the 29th December, the machinery for the Puru Consolidated Company's battery came to hand. The machinery was manufactured at the Union Ironworks of San Francisco, and was shipped through their colonial agents, Messrs. John Burns and Company, of Auckland. The machinery is of the latest and improved type, and is sure to attract the attention of those interested in mining. The mortar-boxes are of a new pattern, known as the "Homestake," which are said to be a considerable improvement on those usually in use. At the mine everything is in readiness for the erection of the battery, and the assaying and retort houses have been completed. The only necessary work which has not yet been finished is the road, and it is hoped that this will be completed without delay.

It is stated that the forty-head stamp battery for the Royal Standard, Wharekiraupanga, is now completed, and only awaits the completion of the tramline for its conveyance to its permanent site. It is further said that there are 12,000 tons of ore in sight, and one hopper containing 500 tons is full.

Golden Age (Waitekauri) : Mr. Corbett and others have pegged out the bed of the Waitekauri, below the battery. The applications will no doubt be opposed by the Waitekauri Company. The cause for the sudden pegging-off was the discovery by Mr. Corbett that particles of coarse quartz sand which had passed the battery screens contained gold to the tune of £1 4s. to the ton. Mr. Corbett proposes to lift the tailings and stack them on the bank. Afterwards he will put them through a berdan, and complete the process by cyaniding. If Mr. Corbett's estimate be not over sanguine, the loss of gold proves that the process of treating the ores of this district has not passed the stage of crudity. The result of the experimental treatment will be awaited with interest.

An inspection of the Waitekauri Company's No. 2 shaft goes to show that Mr. Fraser's (the engineer) tank attachment to the cages are operating with great success in the lifting of the water which has recently flooded the No. 2 level. The first day's operation gave 870 tanks' full for eight hours' work, a discharge equal, approximately, to 370 gallons per minute. The plan of thus utilising the winding-gear in this way is not only a capital means of dealing immediately with an emergency, but has much to recommend it on the score of effectiveness and economy.

Wellington.

Star (Feilding) : An experienced miner from Victoria is now prospecting for gold in the ranges at the back of Apiti. Of course, he is very reticent as to what prospects there are, but from what we can gather from other sources there is every prospect of finding a payable goldfield in the vicinity. Mr. Burton, of Apiti, who, it will be remembered, left for the Old Country lately to take possession of property left to him, had shown us some splendid specimens of quartz and alluvial gold which he obtained in the vicinity referred to.

Nelson and Westland.

Colonist (Nelson): A miner named Jackson—who discovered the Mahakipawa goldfield, for which he received the Government bounty of £500—has discovered, at a spot not more than fifteen miles from Nelson, some very rich specimens of gold-bearing quartz and some alluvial gold, including a very fine nugget. The find has occasioned some excitement in the locality.

For some time past a few gentlemen who have secured an area of land in the Collingwood district have been preparing to turn to profitable account a deposit of plumbago which has been proved to exist on their property. The lode has been opened out, but as yet there is no formed road from the ground where the lode exists to a shipping place, and the want of facilities has proved a hindrance. Samples of the plumbago in question have been very highly spoken of by experts, but the owners resolved some little time back that they would test its commercial value by sending a quantity to the London market. With that object a ton of the plumbago was got out of the lode and packed down to where it could be shipped to Nelson, and the plumbago was put on board the s.s. "Wainui" for transhipment to London. We hope in a few months to hear that it has realised such a price as to warrant extensive operations being carried out, with a view to large and continuous shipments being made.

Grey River Argus: Rich quartz leaders are reported to have been found in the Zealandia claim, Paparoa. It is a pity that rich leaders are so plentiful, and reefs apparently so scarce. It must be remembered, however, that if all the tunnelling and shaft-sinking were put together it would only be a microscopic feature in so large a range. The Zealandia is one of the cluster of claims located on the westward slope of the hill at the head of the Ten-mile. Prospecting is being carried on in several of the claims, but without much vigour.

Curtis Brothers' Victory mine is panning out as well as ever it did. The reef is sound and continuous, without any break of a serious kind.

Some good alluvial ground has been in work lately at the head-waters of the Ten-mile. The upper part of the creek does not appear to have received proper attention as yet. An old prospector informs us that there is a strip of terrace formation high up the creek that ought to pay well if water was brought on to it. It is only the absence of a track, and the extreme ruggedness of the country, that have hitherto prevented prospecting.

The auriferous area in the Barrytown district has been receiving a good deal of attention lately, and several large leases will be applied for shortly. The only hindrance to more being applied for is the want of water-power, and the cost of making it available when found.

A good deal of prospecting is going on at Paparoa on its western slope, and important developments may be looked for shortly. The pegging-out northward seems to have ceased—for the present, at any rate. But this may be altered any day by the discovery of a few ounces of promising looking stone.

More than the ordinary quantity of gold was bought by the banks during the last few weeks. This was only to be expected, for the miners were favoured with an exceptionally generous rainfall.

Negotiations are in progress for the purchase of the Big River and Alexandra properties on the West Coast by a Manchester syndicate.

Mr. Perotti's tramway at the Blackball is making good progress, and will be found a great help in getting machinery on to the range.

An old West Coast miner, Mr. George McCabe, has just returned from South Africa, and after all his experience he says that there is no place like New Zealand. This is significant, because he has no occasion to complain of fortune's treatment of him in Africa. He was employed at good wages all the time he was there. But he could not reconcile himself to the country, to the people, or to his surroundings after having been in New Zealand. He worked in a Johannesburg mine for nearly two years, and during the latter part of his stay he acted as a mining captain at Pilgrim's Rest, the first payable alluvial diggings found in South Africa; but all mining operations there are now confined to quartz reefs.

Brunner News: The prospectors of the lower-level tunnel in the Julian Mine have struck a nice-looking seam of quartz about 1 ft. in thickness. The stone is first-class in appearance, but its valuableness or quantity remains to be proven. The work of prospecting the new find will be pushed on immediately.

Times (Kumara): The prospects of an English company undertaking the work of bringing a water-race from the Kanieri Lake to the Back Creek goldfield are of a very encouraging character. It is understood that a second deposit of £400 has been cabled to secure the rights of Messrs. Davie, Grimmond, and others. This item of news will be hailed with the greatest satisfaction by our Southern neighbours, as the construction of this race will give them a new lease of life. The question whether a work of such national importance should be allowed to get into the hands of a private company need not be discussed here.

Guardian (Hokitika): The Galtee More Sluicing Company's claim at Maori Point, Greenstone, washed up on Thursday with the magnificent return for about five weeks' actual sluicing of 127 oz. 4½ dwt., a result which must be highly gratifying to O'Grady and party, the owners of the above valuable property.

We learn on good authority that there is every probability of water from Kanieri Lake being brought on to Back Creek. This is an important matter for the district, as a large number of miners and others will be added to the population. The Back Creek gold-workings will provide profitable employment for many years.

On dit that there is a demand for options for the purchase of some of the richer claims on the Back Creek field. The demand is said to come from outsiders, which would indicate that there is something of a highly promising character in the negotiations we referred to the other day in the matter of the Back Creek water-supply scheme.

Leader (Hokitika): Gold has been coming in freely during the past few days, and some excellent returns are reported.

It is understood that negotiations have again been initiated in London for an option of the Ross United Company's property.

It is gratifying to learn that the Phillips Dredging Company, Mahinapua Creek, are on highly payable gold, fully equal to their most sanguine expectations. The company appear likely to have a prosperous time before them.

It is reported that twenty-five tenders were received for the contracts advertised for by the Waiho Sluicing Company. Messrs. Wild, Reynolds, and McBeath are understood to be the lowest tenderers, but the amount of the tender has not yet transpired.

Otago and Southland.

Otago Witness: The Pleasant Valley Gold-mining Company washed up for 25 oz. 2 dwt. for seven days. A dividend of 4s. per share has been declared.

It is currently reported that, with the advent of the new year, dredging operations will commence with a view to testing the auriferous resources of the bed of the Taieri River.

Since the month of September last mining operations have been vigorously prosecuted in all parts of the Upper Taieri district. The heavy rainfalls that occurred at brief intervals during the past three months supplied the miners with an abundance of water for sluicing purposes and other requirements. During the past week a number of private parties have been hard at work washing up, so as to be able to hold a Christmas jollification.

In the neighbourhood of the Lammerlaw there has been a large influx of miners from the south, on prospecting bent; while on the other hand the resident miners along the banks of the Taieri have for some time past been busily engaged sluicing down new paddocks of ground, under a heavy pressure of water. Lower down the Taieri River a number of private parties are at work: notably, I may mention Messrs. McKenzie, McDonald (2), Crombie, and several other Europeans I saw a splendid sample of gold of a rough pebbly description. The gully from which it was unearthed is at present being vigorously prospected.

Tuapeka Times: The Woolshed Dredging Company, who hold a claim of 50 acres of ground on Mr. Cameron's property near Glenore, made a formal start with their new dredge on Wednesday last, in the presence of quite a large assemblage, the interesting christening ceremony being performed by Mrs. Wain, who, in the orthodox manner, christened the dredge by breaking a bottle of champagne over it. This part of the function being successfully performed, Mr. W. Moore in a brief address complimented the company on their enterprise, and predicted for the dredge a prosperous future, Mr. Mercer replying on behalf of the company, and thanking those present for their attendance. The Woolshed Dredging Company comprises eight shareholders, two of whom, Messrs. Leslie and Black, are Lawrence residents, the remainder being Messrs. Mercer, G. Telfer, W. Telfer, H. Robertson, R. H. Mitchell, and Hughan Bros. The pontoons of the Woolshed dredge are 60 ft. in length, 8 ft. 6 in. wide, and 5 ft. 2 in. deep, the well-hole being 4 ft. wide, and the poppet-heads 14 ft. high. There are thirty-four buckets of a capacity of about 2¾ cubic feet each, with a ladder 50 ft. long, and capable of dredging to a depth of from 25 ft. to 28 ft. The boiler is 14 ft. long by 4 ft. 6 in. in diameter, with a working pressure of 120 lb. The engine is a compound condensing high-pressure, and is what is known as a 14 in. stroke, and provided with Pickering governors for regulating the speed of the engine. The feed-, air-, and bilge-pumps are worked from the cross-head of the low-pressure piston. She is provided with a perforated screen 15 ft. long by 3 ft. 6 in. in diameter, with $\frac{3}{8}$ in. holes, which is driven from the stem-ends with a rope drive. A stove-shoot 20 ft. long is capable of stacking tailings to a height of 6 ft. The ladder winch is driven by steam off the engine, the barrel of the winch being 20 in. in diameter. The buckets, which are double-linked—this being the only dredge in the district that has double-linked buckets—are driven from a small rope-pulley on the engine, everything in connection therewith being of first-class quality and up-to-date in every particular. The screen-rollers are 18 in. in diameter and 6 in. wide, and are keyed on to axle and run on hard iron bearings. The machinery was supplied by the New Zealand Engineering Company, Mr. Hughan acting as engineer for that company in the erection of the engine, &c.; Mr. Crossly being engineer for the Woolshed Dredging Company. The gold-saving appliances are of the usual kind, and the entire equipment of the dredge is of the most approved pattern, neither expense nor labour having been spared in attaining the highest standard of efficiency, strength, and durability. The dredge, though not in the modern sense a powerful one, is well built and equipped, while the quality of the ground has been many times satisfactorily tested. It may therefore be accepted that the company has a prosperous future before it.

Argus (Cromwell) : There is a regular boom in mining in Ida Valley. The Deep Lead has some appearance of the olden times. The manager of the big company is pushing things along, having got the engine-shed erected and the engine in position, and is busy erecting the poppet-heads and having the shaft marked out, which is the largest shaft ever put down on the lead. I understand he is going for a large block of poor ground which would not pay in the early days, but which he thinks he can make pay well now. More dredging claims have been marked out on the German Hill side, a party from Alexandra having pegged 100 acres at the foot of Maori Gully. In connection with that, I may say that one of our oldest residents had the ground pegged off, but, thinking that, as it could not be heard first Court-day, there was no particular hurry, neglected to lodge his application, with the above result. The "Picaninny rush" at the top of the hill seems to have fizzled out, most of the men having left, a good many, I think, going to get employment on the Deep Lead, between the two companies, but will not get a start until the arrival of more timber.

The Bendigo tributers had a good wash up at the close of the year. The result for ten weeks' work was 384 oz., which will average close on £1 per day per man.

Lake Wakatipu Mail: Mr. W. Birse, mine-manager of the Moonlight Sluicing Company, brought down 217 oz. $12\frac{3}{4}$ dwt. of gold, which, with the addition of two smaller lots brought down (39 oz. $11\frac{1}{2}$ dwt.), makes 257 oz. $4\frac{1}{4}$ dwt. of alluvial gold since the company resumed operations about four months ago. This is very encouraging, seeing that the company are not yet through the whole of the old partially-worked ground. A dividend of 6s. per share will probably be declared, making 10s. for the year just closing—not a bad return on £1 shares (contributing, only 17s. 6d. paid up).

The result of one week's dredging up to Friday, of the Golden Terrace Company (late Sew Hoy Company) was 17 oz. $17\frac{1}{2}$ dwt. of retorted gold—making 45 oz. $9\frac{1}{4}$ dwt. for ten days' work with one dredge since the company has been in operation.

Ensign (Mataura) : Mr. Wadsworth, a Titipua prospector, who has been out on the Lindhurst Hundreds, an auriferous district between Titipua East and Mataura, called at the office, and, from bank receipts which he produced, it appears that the gold won on the property since 20th May last to the 20th instant has been sold to the bank in the following quantities: 11 dwt. 2 gr., 15 dwt., 10 dwt., 3 oz. 9 dwt. 8 gr., 1 oz. 11 dwt. 10 gr., 1 oz. 11 dwt., 5 oz. 11 dwt. 13 gr., 2 dwt. 8gr., 5 oz. 11 dwt. 14 gr. On the 20th December, washings-up for two men, for eight hours' work, resulted in 8 dwt. being secured. From what can be gathered the claim is admirably suited for either ground- or hydraulic-sluicing. The materials treated gave gold to the value of 3s. to 12s. per yard. For thoroughly equipped men the field should prove a good one, but it would be no use for men to go without money and appliances. There is plenty of water available, and if a company were to commence operations it would, in Mr. Wadsworth's opinion, be very successful. The Government have set aside 1,335 acres in the district on account of its auriferous nature; but outside of this there are, Mr. Wadsworth states, some two to three thousand acres of the Titipua and Hedgehope Rivers fit for dredging.

Press (Christchurch) : Mr. A. Waddell, who has been exploring the country in the vicinity of Preservation Inlet, has returned to Christchurch, with the view of taking over an expedition to explore the country between the inlet and Lake Manapouri. The expedition will consist of four experienced bushmen and himself. During his recent explorations Mr. Waddell states that he discovered two reefs at the eastern end of Wilson's River, which he intends to open out on behalf of a Christchurch syndicate. Mr. Waddell has two dépôts of provisions at Preservation Inlet for the use of the party.

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YIELDS FROM THE NORTHERN GOLDFIELDS.

The *New Zealand Herald* states that the gold yields of the northern goldfields for 1897 show a substantial increase of £72,995 over those of the preceding year. The *Herald* tabulates the returns as follows, and, although the figures do not always correspond with the official returns, they may be taken as approximately correct:—

Upper Thames.

		Value.		
	Tons.	£	s.	d.
Waihi G.M. Co.	40,764	143,291	17	8
Waitekauri G.M. Co.	..	51,870	11	9
Woodstock	..	30,805	0	0
Waihi-Silverton	..	17,281	0	0
New Zealand Crown	..	43,433	1	8
New Zealand Talisman	..	10,498	19	2
Komata Reefs	1,000	3,300	0	0
Young New Zealand	1	18	14	0
Waitekauri King	1	5	12	0
Grace Darling (approximate)	50	160	0	0
Total		£300,664	16	3

Lower Thames.

	Oz.	dwt.	£	s.	d.
Adelaide G.M. Co., 296 loads	228	12	670	11	3
Alburnia East G.M. Co., 13 loads ..	14	0	37	5	2
Claremont Claim, 194lb.	167	6	470	0	0
Hauraki Anchor, 181 tons	139	14	370	0	0
Hihi Claim, 7 tons	59	16	185	4	10
Judd's Tailing Plant, 4,010 tons ..	784	12	1,890	0	0
Kaiser G.M. Co., 39 tons	38	17	124	11	2
Kuranui-Caledonian G.M. Co., 3,226 loads	1,575	2	4,205	19	1
Mahara-Royal G.M. Co., 425 tons ..	307	18	919	5	8
May Queen-Hauraki G.M. Co., 409 loads	595	18	1,611	13	7
May Queen-Hauraki tributers, 17 loads	52	17	142	15	0
New Alburnia G.M. Co., 3,993 tons ..	2,092	17	5,547	17	8
Nonpareil G.M. Co., 186 loads ..	323	1	903	11	2
Occidental G.M. Co., 28 loads ..	58	19	158	13	10
Scandinavian G.M. Co., 3 loads ..	4	7	12	17	6
Sheridan G.M. Co., 573 tons	209	13	646	0	0
Sundries, 1,000 tons	996	11	2,125	8	9
Tararu Creek G.M. Co., 2,547 tons of ore	792	17	2,077	5	5
Tararu Creek G.M. Co., 2,845 tons of tailings	2,119	0	1,249	17	0
Victoria G.M. Co., 684 loads	991	7	2,775	5	10
Waiotahi G.M. Co., 1,015 tons ..	1,375	10	3,765	10	2
Grand total	12,737	0	£29,889	13	1

Coromandel.

			Value.		
	Oz.	dwt.	£	s.	d.
Blagrove's Freehold, 4 tons	32	0	92	0	0
Bunker's Hill, 15 tons	57	5	170	0	0
Four-in-Hand, 82 lb.	..		393	13	4
Golden Lead, 10 tons	4	18	14	14	0
Golden Pah	71	3	369	13	0
Golden Pah, tribute	..		46	10	0
Hauraki G.M. Co., 4,275 tons ..	11,790	18	35,475	0	4
Hauraki Associated, 100 tons and 90 lb.	422	5	1,219	4	0
Hauraki Main Lodes, 4 tons	4	6	12	18	0
Hauraki North	..		1,179	19	10
Jersey, 2 tons	51	8	150	0	0
Kapanga G.M. Co.	206	15	582	5	0
Kapanga Tributes	..		473	0	0
Progress-Castle Rock, 17 cwt. ..	59	14	154	9	10
Queen Victoria, 15 tons	20	0	50	0	0
Royal Oak	7,416	18	18,611	0	8
Scotty's	196	0	571	1	0
Success	446	18	1,336	14	0
Sundries	200	0	550	0	0
Tokatea Consols, 33 tons	167	0	487	10	0
Welcome Find, 88 tons	466	10	1,375	19	0
Hauraki South	9	5	28	4	3
Kathleen Crown	6	17	19	10	0
Buffalo, 20 lb.	19	2	56	0	0
Forest Queen, 19 cwt.	..		25	10	0
Hinemoa-Hauraki	..		7	6	0
Waikoromiko, 1 ton	..		262	10	0
Totals			£63,714	12	3

Kuaotunu.

	Oz.	dwt.	£	s.	d.
Kapai-Vermont, 3,214 tons	2,235	0	5,447	17	5
Mariposa, 3,786 tons	558	11	1,452	0	0
Sundries	100	0	270	0	0
Juno	79	11	209	10	0
Waitaia	..		60	16	5
Totals			£7,440	3	10

Great Barrier.

	£	s.	d.
Great Barrier Company, 2 tons	£27	19	0

	£	s.	d.
Upper Thames	300,664	16	3
Lower Thames	29,889	13	1
Coromandel	63,714	12	3
Kuaotunu	7,440	3	10
Great Barrier	27	19	0
Total for year	£401,737	4	5
Total for 1896	328,741	11	10
Increase	£72,995	12	7

An application for a grant of £300 has been received from the Westport County Council towards the cost of repairing the Argyle Water-race, which was constructed some years ago to supply the mines at Charleston with water; but since then the Council borrowed £4,500 under the Local Bodies' Loans Act, to bring in from the Four-mile River an enlarged and assured supply of water for the mines, and a special rate of 3¾d. in the pound is levied to pay the interest on the loan. The special rate and the money realised by the sales of water have been found insufficient to pay the interest on the loan, and the Council had in consequence to pay £126 3s. 6d. in July, 1896, and £72 in February, 1897, from the County Fund to make up the deficiency. A reply has been sent to the Council to the effect that, in consequence of the agreement entered into with the General Exploration Company (Limited), the Government have been relieved of all further claims for assistance towards the cost of keeping the race in repair.

EXPLOSIONS IN COAL-MINES.

[By Mr. JOHN HAYES, F.S.Sc., M.E., Acting Inspector of Mines, Dunedin.]

II.

ALTHOUGH Faraday and Lyell had reported on the danger of coal-dust thirty years previously, it appears somewhat remarkable that the subject had not been more generally thought out, but, with the exception of a few isolated individuals, the mining profession paid practically no attention to so important a question, and (in the light of present-day knowledge), it may be regarded as a certainty that many of the severe explosions of the past have been attributed to firedamp mixture which in reality may have been originated either by the ignition of gas, or by a blown-out shot in the absence of firedamp, and carried on by coal-dust.*

In 1879 a Royal Commission on Accidents in Mines was set up by the British Government. The Commissioners obtained a large amount of evidence on the subject of explosions during their investigations, which extended over a period of some seven years, their final report being made in March, 1886. During the earlier stages of their labours the Commissioners found that the preponderance of opinion among the British Mines Inspectors was against the view that explosions could originate, or be to any extent propagated by coal-dust in the absence of firedamp.

As the writer can personally testify, very few mining people attached much if any importance to what was then called "the coal-dust theory"; but during 1880 two serious explosions took place in the South Wales Coalfield, and one in the Durham Coalfield, which did much to show that the "theory" of coal-dust as an explosive agent was in reality a stern fact. In connection with the explosion in Durham (Seaham Colliery) the opinion was strongly entertained that it was entirely due to the ignition of coal-dust, in the absence of gas, by flame from a blown-out shot. This explosion was investigated by Messrs. W. N. and J. B. Atkinson, two of Her Majesty's Inspectors of Mines. They state: "The only substances which had ever been regarded as contributory to colliery explosions are firedamp and coal-dust, and until recently the influence of the latter was practically ignored." They show that on the main haulage roads, through which large volumes of air were regularly circulated, and where naked lights had been used for years, it was incredible to suppose any accumulation of firedamp, yet it was on these very roads that the explosive forces were greatest; in fact, the explosion was confined practically to the haulage roads, which were dry and dusty. Messrs. Atkinson state their belief that the explosion originated from a shot fired in a part of one of the main roads (where it was cut in stone) during the process of enlarging a refuge-hole, and that the flame from the shot ignited the dust. They say that "the indications of force strongly point to this place as being the starting-point of the explosion; force radiating from here in three directions."

In consequence of the evidence disclosed by the Seaham disaster, a series of experiments with coal-dust were initiated in various parts of the kingdom.

At a large Yorkshire colliery known to the writer, an explosion occurred in October, 1886, on a main haulage and intake airway. From the evidence, it appeared altogether impossible that firedamp could have had any part in the matter; in fact, the character of the afterdamp seemed sufficient in itself to preclude such an idea, and the Coroner's jury in returning their verdict found "That the explosion was caused through the ignition of coal-dust, consequent on the firing of a badly-drilled shot."

Messrs. W. N. and J. B. Atkinson published in 1886 a valuable little work on "Explosions in Coal-mines," giving the result of their investigations into six large colliery explosions in the North of England—viz., Seaham (1880), Trimdon Grange (1882), Tudhoe (1882), West Stanley (1882), Whitehaven (1882), and Usworth (1885). They point out that in the Whitehaven explosion, coal-dust could have played no part; it was one of firedamp mixture, and, although a gust of air was felt a mile away, the violence of the explosion was confined to the immediate vicinity of its origin. Its violence or force was less than in any of the other five explosions. Flame did not extend 50 yards from where the explosive mixture existed before ignition. The workmen had been under some sense of alarm beforehand, and were moving away. Their bodies were not so severely burned as in the case in explosions in dusty mines, and, except on the bodies of the victims, no other signs of burning were observed.

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* In 1878, an explosion occurred at a Lancashire Colliery by which 189 persons lost their lives. This was known to be a gaseous mine, and the general opinion was that the explosion was due to a sudden and violent outburst of gas, and its subsequent ignition by flame passing the gauze of a Davy-lamp. No doubt this view was correct. A year or two afterwards, when the writer was put in charge of the surveys of that and neighbouring collieries, he inquired into and studied the question of the explosion for his own satisfaction, with the result that, in his opinion, the explosion, although one of CH_4 and air in its inception, was intensified by coal-dust, the mine being dry and warm. Some months afterwards a sudden outburst of CH_4 occurred at the mine, but the men were all safely withdrawn. For some days the gas roared like steam escaping from a boiler.

Messrs. Atkinson state that the other five explosions all presented the following features: (*a.*) In the absence of a knowledge of the danger of coal-dust, they could not have been expected. No accumulations of gas were known to exist approaching in quantity what would be necessary to cause the widespread destruction, nor were such accumulations considered possible. (*b.*) In all cases the violence and flame of the explosions were confined to those roads on which there was much coal-dust, the greatest force being on the intake and haulage roads where gas could be least expected, and where naked lights were daily used. (*c.*) In many cases the explosions were arrested where the haulage roads were wet and damp. In no case was there any evidence of alarm among the workmen prior to explosion. (*d.*) Carbonic oxide (carbon-monoxide) was evidently present in the afterdamp, rescuers being overpowered while their lamps burned brightly; in some instances workmen's lights had continued to burn till all the oil in the lamps was consumed, the workmen having apparently died from the poisonous nature of the gas while the lights were still burning.

Partly as the result of the report of the Royal Commission already referred to, the British Coal Mines Regulation Act of 1872 was repealed in 1887, and a new Act passed which placed increased restrictions on blasting in mines, and officially recognised coal-dust as an element of danger.

In April, 1888, an explosion took place at a large Cumberland colliery near the mines then under the writer's charge. He was sent for immediately the disaster occurred, and took share in the control of the works during the recovery of the bodies and restoration of ventilation, &c. This explosion was primarily caused by the ignition of a mixture of firedamp, air, and coal-gas distilled from the seam itself (owing to the latter being accidentally set on fire in the very extreme end of the workings), but carried on against the air-current along the intake airways and right to the downcast shaft for a distance of about a mile, dealing death and destruction all along the track. Men and horses were scorched and killed at places far from the seat of the explosion, where it was utterly impossible for any accumulation of gas to exist. Nothing but the ignition of coal-dust and the explosion of its occluded gases could possibly have intensified this explosion to such an extent. The nature of the afterdamp and its effects upon the rescue parties, as well as the condition of the bodies of men killed, all point in this direction.

From 1888 to 1892 several explosions were clearly traced to coal-dust in the absence of firedamp. America contributed one case—viz., the Castle Gate Mine, Utah—where one shot-lighter and two miners (the only persons in the workings at the time) were killed. The cause is distinctly given as attributable to a blown-out shot, and the explosion was very severe. It is said the mine was free from gas, but very dusty.

In the south-west of England two explosions occurred at collieries which had been worked for generations, and where firedamp was unknown. They were traced to blown-out shots and coal-dust.

Owing to such evidences as those just cited, the British Government set up a Royal Commission on Coal-dust Explosions. Under the direction of the Commission numerous experiments were carried out by Mr. Inspector Hall, and evidence was obtained from other investigators. In 1894 the Commission presented its report, of which the following is the summary:—

1. The danger of explosion in a mine in which gas exists, even in small quantities, is greatly increased by the presence of coal-dust.

2. A gas explosion in a fiery mine may be intensified, and carried on indefinitely, by coal-dust raised by the explosion itself.

3. Coal-dust alone, without the presence of any gas at all, may cause a dangerous explosion if ignited by a blown-out shot or other violent inflammation. To produce such a result, however, the conditions must be exceptional and are only likely to be produced on rare occasions.

4. Different dusts are inflammable and consequently dangerous in varying degrees, but it cannot be said with absolute certainty that any dust is entirely free from risk.

5. There appears to be no probability that a dangerous explosion of coal-dust alone could ever be produced in a mine by a naked light or ordinary flame.

To further demonstrate that coal-dust without firedamp will carry on an explosion, Mr. Galloway made a series of public experiments at Merthyr-Tydvil, South Wales, in December, 1894. A large tube was constructed and fitted with a fan for the double purpose of creating a current and of mixing coal-dust with the air. A cannon was utilised to represent a blown-out shot. In all, sixteen experiments were made, proving most conclusively that a blown-out shot and a dust-laden atmosphere will initiate a serious explosion. It will be sufficient to refer to a few of the results obtained: A cannon-shot, with 1 oz. of gunpowder, carefully stemmed, placed on a ledge 9 in. from the ground, fired into vacancy, produced a flame 3 ft. long. Same charge repeated, but stemmed with 1 oz. coarse coal-dust, produced a flame 7 ft. long, when fired from same position. Similar charge, ordinary stemming, fired into the tube, which contained 1 lb. coal-dust, produced flame 12 ft. long. Similar charge, stemmed with 1 oz. coal-dust, fired into the tube containing 1 lb. coal-dust as before, produced a 15 ft. flame of much greater volume. Similar charge, fired into tube 18 ft. long containing 2 lb. of coarse coal-dust well agitated, produced a flame 23½ ft. long.

A "blown-out shot" is said to take place when a charge of powder or other explosive (intended to blast down coal or rock) fails to do the work intended, and blows out its stemming instead. It acts practically like a cannon—in fact, under such circumstances, the drill-hole is to all intents and purposes a cannon—from the mouth of which flame is projected more or less in extent and violence according to the amount and quality of powder used, the tightness of the stemming, and the class of stemming-material employed. From Mr. Galloway's experiments it will be seen that where coal-dust has been used for this latter purpose serious results may ensue. Although in direct violation of colliery regulations, the writer has on different occasions found evidence of the miners having used coal-dust and fine slack for stemming. Surface-clay and soil are good and safe materials for this purpose.

In a recent work on coal-mining, the author, Mr. H. W. Hughes, makes the following remarks *re* blown-out shots: "The combustion of powder produces large quantities of gaseous products, which, as in the case of blown-out shots, are driven violently into the roadways, and at the point of discharge act like a piston, driving back the air flowing past the hole in both directions, and producing a partial vacuum, into which the gas contained in the coal is exhausted and diluted with the air-current until the firing-point is reached. Clouds of dust may be raised at the same time, and if this mixture comes in contact with the flame, a serious explosion is readily produced.* It has also been suggested that a sound-wave produced by a blown-out shot may cause sufficient pulsation in the atmosphere to force flame through an ordinary safety-lamp."

Professor Vivian B. Lewes, of the Royal Naval College, Greenwich, in giving an analysis of the resulting gases from blasting-powder, states that 51·18 per cent. are incombustible, and 48·82 per cent. combustible. Of the latter, carbon-monoxide chiefly prevails. He also says that traces of carbon-monoxide (CO) in air laden with coal-dust will render it just as explosive as if a small percentage of firedamp were present (as already referred to in connection with Mr. Galloway's early investigations) and that "the temperature necessary to ignite a mixture of carbon-monoxide and dust-laden air is lower than that required to ignite a mixture of fire-damp and air." The Professor therefore concludes that "when the air of a mine is charged with coal-dust, the probabilities are that a very large volume of explosive mixture is formed by the rapid escape of the products of combustion into the dust-laden air, and this (being either ignited by the flame or by red-hot solid products driven out into it by a blown shot)* initiates a considerable area of explosion."

Professor Lewes further states with reference to blasting-powder that "a charge weighing 1¼lb. gives off 3 cubic feet of combustible gas, which, when mixed with pure air, gives over 10 cubic feet of an explosive or rapidly-burning mixture." From this we learn that the flame of a blown-out shot does not only ignite coal-dust, but the shot supplies a combustible gas that quickens the inert fuel and makes it burn with explosive fierceness. (*Vide Colliery Engineer*.)

Mr. James Ashworth, a well-known English mining engineer, and a personal friend of the writer's, in a recent article in the *Colliery Guardian* states: "It is now an established fact that, in the absence of fire-damp, if carbon-monoxide and flame from a blown-out shot is projected into air holding in suspension only a little coal-dust, an explosion ensues which is the nucleus of a greater one, for if the first explosion raises a cloud of inflammable dust the second one fills the mine with flame." This explanation conveys an idea of the general effect, and, while good to that extent, does not show how the general effect is produced, at least in the opinion of the present writer, who concludes that what is known as a coal-dust explosion is really a rapid series of successive explosions of an atmosphere containing hydrogen gas and volatile vapours evolved or distilled from coal-dust and fine slack, together with very fine dust in suspension, and certainly a percentage of carbon-monoxide. The initiatory cause may be the explosion of a small quantity of firedamp mixture or a powder-shot, either of which would create a wave in the air sufficient to disturb any dust in the immediate locality, and the flame and great heat from such an explosion—especially from a blown-out shot—being forcibly projected into this dust-laden atmosphere would instantly ignite a portion of it, and distil gas and volatile hydrocarbons, thus naturally providing the necessary material for a second explosion on a far larger scale than the first. This in turn produces the sinews of war for a third, and so the process will be repeated, with intensified heat and force at each repetition so long as there is dust or fine slack available on the one hand, and oxygen to support combustion on the other, the repetitions being so close upon one another as to practically form one huge explosion.

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* Mr. Hughes (unintentionally, no doubt) describes what actually took place at a Lancashire colliery with which the writer was once connected. Two shot-lighters only were in the mine. Two shots were to be fired adjacent to each other and at the same time. One was found to have "blown-out." It is supposed this went off first, the flame from the second one acting as Mr. Hughes states. An explosion took place. Both the men were found dead. The mine was splendidly ventilated, but the seam dry and very gaseous.

* Several authorities agree that the temperature produced by the explosion of ordinary miners' blasting powder, when confined (as in a shot-hole) is about 4,000° Fahr. The average temperature at retorts at Invercargill Gasworks during gas-making is given at 2,225° Fahr. by Mr. J. E. Hawkins, manager, 9th March, 1897.

Where parts of a mine are only damp or moist, and not soaking wet, the heat evaporates the moisture, so making these parts dry and dusty, and at the same time combustion is, to some extent, assisted by the moisture (on account of its contained oxygen) becoming vaporised. A reasonable length of really wet roadway will, however, usually arrest the extension of a dust explosion.

It appears in every way probable that, owing to the power of explosive forces in driving back the air-current, together with the effects of the great heat in liberating inflammable gases by distillation from coal-dust and slack, an explosion may, in a measure, terminate in one place (or part of a mine) for want of sufficient air to make these gases explosive, only to burst out again elsewhere when they become mixed with air in explosive proportions. It must be borne in mind that a back-rush of air takes place after a violent disturbance. The evolved gases would follow the out-rush, and might travel a considerable distance prior to the back-rush of air taking place, upon which they would quickly become explosive, the heat generated by compression materially assisting in this direction. This view, the writer thinks, may help to throw some light on the reason why evidences of fire and violence are sometimes met with after an explosion, wide distances apart, without any apparently strong evidences of connection.

"Afterdamp" has been referred to. This is the technical term for the resultant gases of a mine-explosion. In the case of firedamp mixture it consists of free nitrogen, 71·2 per cent.; carbonic acid (carbon-dioxide), 9·6 per cent.; and steam, 19·2 per cent.;* but as the latter soon condenses, the resulting afterdamp is composed of practically 88 per. cent. of nitrogen and 12 per cent. of carbon-dioxide. Such an atmosphere is very deadly—lights will not burn in it, and men who escape the fiery blast itself generally become victims to afterdamp.

Where coal-dust has been exploded the afterdamp is somewhat different in its composition, containing (according to the investigations of Dr. Haldane, of Oxford University) from 80 to 85 per cent. of nitrogen, and a mixture of carbon-dioxide, carbon-monoxide, hydrogen, sulphurous acid, and probably a small proportion of volatile gases. It is even more deadly than the afterdamp resulting from an explosion of firedamp mixture.

Professor (Dr.) Haldane was in the year 1896 instructed by the British Home Office to report on "The Causes of Death in Colliery Explosions." He went carefully and exhaustively into the subject, and the report largely confirms the investigations of others which have already been referred to by the writer. Professor Haldane shows plainly how, in explosions, coal-dust is subjected to destructive distillation, giving up, under the influence of heat, a portion of its occluded gases and volatile vapours, also that combustion cannot well be so perfect as in an explosion of firedamp mixture, yielding as a natural consequence a good percentage of the deadly carbon-monoxide, 2 per cent. of which will, if breathed, soon cause death, and that a large proportion of deaths in recent explosions are due to this gas.

In an atmosphere containing carbon-monoxide lights burn brilliantly, yet explorers are overcome by it: 1 per cent. causes dizziness and faintness. Persons who have been breathing an atmosphere in which it is present to a much smaller extent than 1 per cent. often become unconscious on being brought into fresh air, and, in some cases, similar effects to those produced by alcoholic intoxication ensue.

With reference to the explosion at Brunner Colliery, near Greymouth, New Zealand, in March, 1896, the effects of the afterdamp on some of the rescuers were decidedly due to carbon-monoxide. Under instructions from the Government, the writer, along with Mr. T. Brown, of Westport Colliery, and Mr. N. D. Cochrane, Inspector of Mines for the district, made a careful inspection of the entire mine, and could come to no other reasonable conclusion than that the explosion was, as a whole, caused by a blown-out shot of ordinary blasting-powder, which may possibly have been stemmed with fine slack, and carried on, as already described, by distillation of coal-dust. How or by what means the shot was lit is not definitely proved, but its locality offered a striking illustration of the remarks of Professor Faraday. The place *had* literally "glowed like a furnace," solid coal being carbonised into bright silvery coke for a considerable depth, and the volatile matter distilled out of the roof-coal, from which were hanging, like black stalactites, droppers of brittle carbon, up to 4 in. in length. Professor Black, of the Otago University, who analysed samples of the cohesive charred dust taken from various parts of this mine after the explosion, found that about one-third of the hydro-carbons and coal gas originally contained in the coal had been distilled.

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* These figures are to be taken as approximate, owing to the fact that the conditions of the explosive atmosphere vary in different explosions. Sufficient oxygen to insure complete combustion may not always be available.

To prohibit blasting altogether in coal-mines would mean the total closing of many collieries, but during the past few years it has been recognised that some safer agent than ordinary miners' powder is necessary. This recognition has led to much chemical research, resulting in the introduction of carbonite, roburite, and a host of other explosives, some of which are nitro-glycerine compounds, others containing ammonium-nitrate as their base, in combination with di-nitro benzol or other suitable ingredients. All these explosives are fired by detonation, preferably in connection with an electric battery. Many of them are almost practically flameless if properly charged. Those containing large proportions of ammonium-nitrate are said not to produce carbon-monoxide when fired: this feature should commend itself to those in charge of dusty mines.

It appears quite evident that, under present conditions of coal-mining, immunity from explosions lies principally in the adoption of a safe agent for blasting, since ventilation is, as a rule, so well maintained in all well-organized collieries that firedamp gets very little chance to accumulate, and safety-lamps, where used, are now generally so constructed that the light becomes extinguished in an explosive gaseous mixture. They are also shielded to resist high velocities, so that the passage of flame through the gauze —which in the case of the old Davy-lamp has been known to occur—is a remote contingency.

A VOTE of £30,000 has been passed by the Western Australian Parliament for the erection of public batteries on the goldfields.

CONTRIBUTIONS TO THE CHEMISTRY OF THE CYANIDE PROCESS.

[BY MR. WILLIAM SKEY, Analyst to the New Zealand Mines Department and Government Analyst.]

THE great and growing importance of the cyanide process for extracting gold from its matrices makes anything that is explanatory of the chemistry of this process interesting, and more or less valuable according to its precise nature.

In this place I would first refer to the fact that, in 1895, in the annual report of the Mines Department is a copy of a report of mine to the Hon. the Minister of Mines, in which I describe certain singular effects that occur when a piece of gold-leaf is partly immersed in an aqueous solution of potassic cyanide, also other phenomena, and which appeared to me at that time not easily explainable; and, being then pressed for time, I let these matters stand over, but I promised a further investigation of them, and a statement of the results thereof, at the first opportunity. I have since spent a good deal of time in following up these subjects, and have communicated some results thereon to the public at various times, but not in the Mines Reports. I now, therefore, make a special report of these results, together with other later ones of mine that have not yet been published, so as to give a complete and connected account of my investigations of the subject since the publication of the report referred to (1895). For this purpose I shall not keep to the order of time, but shall arrange the facts brought out by them, so that they shall be stated in a natural sequence, and in such a way that their comprehension by the reader may be as easy as possible. I will first deal with those results that bear upon the question—

HOW IS THE CYANIDING OF GOLD EFFECTED?

Every chemist of our cyanide plants is now very well aware that to do this profitably a very weak solution of potassic cyanide, or its chemical equivalent, free oxygen, and, of course, a sufficiency of gold in a rather fine state of division, are necessary; and he further knows that it so happens that the gold he wins is won as the *auro-cyanide of potassium*, but the precise way in which this happy event comes about he does not know. A good deal he knows, and he has several plausible-looking theories to choose from for his guidance and information; but (as it appears to me, at least) there are certain facts underlying the whole process—certain phenomena—

hitherto unknown, which, if circumstances were unfavourable for their occurrence, would make any attempt to cyanide gold at all a complete failure. It is these facts that I shall endeavour to show as clearly as I can; and, as it so happens that the experimental results upon which my evidence for these facts is grounded were initiated by the study of a remarkable phenomenon first noticed by Professor Faraday, I commence my subject by reference to this.

It was in the year 1857, in his Bakerian Lecture, that this eminent chemist informed the scientific world that gold-leaf, as resting on the surface of a solution of potassic cyanide, dissolves about one hundred times quicker than gold-leaf that is wholly immersed therein—a fact that is now taken advantage of by cyaniders for a rough and ready test of the strength of their cyanide solution. The difference is, indeed, marvellous, and there are at present two theories proposed to account for this. The first in time is that of Faraday himself, to which, indeed, great weight should attach notwithstanding its antiquity. It has not (to my knowledge, at least) hitherto been directly challenged. It is, as stated in his own words, "air voltaic currents are formed in these cases" (the cyaniding of gold resting on the solution), "and the gold is dissolved almost entirely under their influence."

The next theory is one which, if not yet precisely formulated in a public print, is, as far as I can learn, the popular one among the cyaniders, as it really appears to exactly fit the facts of the case. Taking cognisance of the fact that oxygen is a necessary factor in the process, and is far more plentiful at the surface of the cyanide solution than in the solution itself, it claims that this rapid dissolution of gold at the surface is simply due to the plentiful supply of this gas. In this connection it is right that I should take cognisance of the fact that Mr. Maclaurin, F.C.S., has given us a theory to explain the rapid action of cyanide solutions on gold so placed that, as he suggests, it may be considered as only an extension of the under-surface of gold in the position described, and consequently is a theory that, if true, goes to explain the particular phenomenon under consideration here, and therefore has to be noticed in this communication. This theory, then, maintains that there is generated at the surface of the cyanide solution on which gold is resting a current of electricity, and that this current causes the solution of the gold (at least, the gold immediately under that having contact with atmosphere)—that, in his own words, "the solution of this gold is due to electrolytic action obtained by the action of the cyanide and the oxygen of air."*

This is the theory that Mr. Maclaurin offers us to explain the rapid dissolution of the under-parts of gold resting on a cyanide solution. However, as previous to the reading of the paper embodying this theory I had shown that the current which does obtain in this case is just in the reverse direction to what he affirms it to be, I need not do more than state the fact that this gold is not brought into solution by an electrical current at all. There is therefore no necessity for me to treat this theory separately, so I proceed with my discussion of the theory first stated—that of Professor Faraday.

In regard, then, to this theory, it appears to me that this scientist, in his eagerness to pursue the main investigation—the real object of his labour—contented himself here to take a course very unusual for him—to make, as it were, a snapshot; for had his mind not been so preoccupied he would certainly have followed up the matter, and just as certainly he would have solved the enigma—nay, it is my firm belief that he, with the wonderful all-round faculties he had for scientific investigation, the great capacity he had for entertaining and successfully grappling with phenomena, whether those of astronomical magnitude or those equally difficult and no less entertaining, so minute as almost to elude not only investigation but even perception itself—it is, I say, my firm belief that he would have followed up his labours in this direction, and crowned them by the discovery of the extraordinary, the unexpected potency of the weak cyanide solution, and then, in his own good time, have conferred a gift to the world that would have anticipated that miner, to us unknown, who, in sheer desperation to make the cyanide process a workable one, blundered to the discovery of this strange potency of the weak solution. However, Faraday lost the opportunity to benefit the miner in this way, but only to take opportunities of serving man in the higher reaches of science, leaving us only, as I have said, a bare theory to interpret the phenomenon that he discovered, and which I have here to discuss.

Now, as to this matter, I would like to know the *modus operandi* of the production of these "air voltaic currents" that this scientist states are the agents for thus rapidly dissolving gold lying in the solution. As I take it, an air voltaic current is one that can exist in the air alone, or is produced there by the assistance of this surface gold and the cyanide solution; but how is the current formed, and, when formed, how does it promote the solution of the gold? But, whatever answers may be framed to these questions, the following facts certainly appear to show that the "air voltaic current" theory is not tenable. If the gold-leaf and the surrounding cyanide solution be covered with a thick layer of kerosene or gasoline the dissolution of that gold is but little retarded.* Ether can be substituted for these oils with like effect if only the cyanide solution is very strong or has been heavily salted to prevent the downward diffusion of the ether, and so favour the existence of a hard line of demarcation between the two liquids. All these substances are, I find, slowly permeable by oxygen; still, apparently, not notably more so than water is: but the same results happened when they were depleted of their contained gases by passing coal-gas through them, and even when the gold-leaf itself was also depleted more or less of the air lodged in its pores by the same gas.

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* "On the Action of Potassium-cyanide Solution upon Gold." (Trans. N.Z. Inst., Vol. xxviii., Art. lxxiii.)

These facts, then, I think, clearly prove that, for the rapid dissolution of gold-leaf on the cyanide solution, a body of air resting on that solution is not at all necessary. They show, on the other hand, that there is entangled in the pores of the gold-leaf,† or mechanically absorbed by it, a sufficiency of oxygen to provide for a rapid dissolution of the metal. These facts, to my mind, strike, and fatally, at one and the same time at both the theory of Faraday and the popular theory that the profuse supply of oxygen has largely to do with this rapid dissolution of gold.

Now, the result just stated, while, as I think, disproving the two theories specified, raises a question of great pertinency to the subject—one which, if fairly answered, should lead to the settlement of the question that I set out with, How is the cyaniding of gold effected? And it is this: Why should gold-leaf in a cyanide solution be very much longer in dissolving than gold-leaf lying on the surface, and under a layer of oil or ether, the necessary supply of oxygen being in each case, as it were, afoot—that is, lodged in the gold-leaf? Well, the answer—and I believe the only answer—to this question is one that rests largely for support on results and deductions therefrom which were started by the observation of another phenomenon almost as singular as the one that we have been attempting to explain, and which I announced in 1895,‡ and it is this: A piece of gold (say, gold-leaf) that is immersed in a cyanide partly-solution, weak or strong, not only dissolves rapidly at the surface of that liquid, as Faraday announced, but also rapidly—often just as rapidly—in the liquid itself, and even at those parts that are quite distant from the surface.

Here, then, to me, as it would have been to any other chemist, was a very suggestive fact, and a means offered whereby the singular phenomenon that Faraday discovered might be hopefully investigated. Now, the part of the gold-leaf that is immersed in the cyanide solution may be viewed as merely an extension of the under-surface of the gold-leaf that lies on the surface of this solution, and so I was led to suppose that the phenomenon had, as it were, an electrical side—was, in fact, if not produced electrically, at least contemporaneous and connected with a current of electricity; so, acting on this idea, I connected a square of gold-leaf that laid on the cyanide solution with a square of the leaf submerged therein, through a galvanometer, when an electric current manifested its presence, the direction of which would have been a surprise to Faraday himself, for it indicated that the current proceeded from the submerged gold. Thus the idea of the rapid dissolution of gold lying on a cyanide solution being due to electro-motive force generated at the surface, as Faraday supposes, receives a very rude shock.

Following up this new line of investigation it was soon found that gold in strong solutions of the cyanide is always positive to gold in weak solutions of this salt, and that the current thus generated is sufficiently strong to give electrolytic effects—*e.g.*, the deposition of copper and gold from their sulphate and chloride respectively. These results, while showing clearly and undeniably that the rapidity with which gold dissolves when lying on a cyanide solution is not due to the generation of any electrical current at all, shows just as clearly the fact of the potency of cyanide solutions of different strengths in contact with the gold for accelerating the cyaniding of the metal; and the inference I would make from this is that the rapidity with which this surface gold dissolves is in greater part, if not wholly, due to the action of cyanide of different strengths—in fact, to the action of the stronger solution on the under-surface of the leaf, its upper surface forming in the weaker cyanide the negative pole.

Now that the solutions in the vicinity of the gold-leaf as there situated are, or soon get to be, of different strength appears certain, for the following reasons: Gold-leaf is, as Faraday long ago pointed out, very porous, and it is easily conceivable that the easily-decomposable cyanide solution, rising through the capillary pores of the metal, and subjected therein to oxygen condensed on their sides, would undergo a partial decomposition. There is this, too, to be taken cognisance of, and that helps to perpetuate this difference in cyanide strength: The solution next the air cannot so well be recuperated from the normal solution as can the solution underneath, the former being almost cut off from the underlying solution.

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* Trans. N.Z. Inst. for 1896, p. 581. † Faraday shows this leaf is full of pores. ‡ Mines Report, 1895, pp. 186–189.

In this connection I would state that my experiments show a very small negative pole will serve for quite a large positive pole, reckoning by superficies. Therefore a local weakening of the solution at any point would give us a general dissolution of gold over the parts of the metal that have still contact with the normal solution. If any one should reply to this theory for the dissolution of gold that by the same rule a solid body—say, glass—placed over the gold-leaf should also favour the production of the heterogeneity in the solution which my theory requires, and *which it does not*, I would answer that solid substances thus placed prevent the escape of air out of the capillary cavities or pores of the gold-leaf, and so keep the cyanide solution from that contact with the surface gold necessary to complete the interpolar connection between its upper and lower surfaces.

Now, if differentiation of the strength of the cyanide solution does explain the rapidity with which gold, as placed on a cyanide solution, is dissolved, differentiation in strength must be a factor in the dissolution of gold in the cyanide process generally. I conceive it, indeed, to be the key, the mainstay, of the process as worked at the mines. The initiation of this is easy, and easy to understand: the percolation of the cyanide solution through the charge—this "drip, drip, drip"—and in a damp atmosphere, is all very favourable for its production, also for its maintenance. Thus the cyaniding of gold appears to be eminently an electric process: not that the gold is dissolved therein by means of electric currents (not even in the case of gold on the cyanide), but that, on the other hand, it generates these currents—gives us, in fact, electro-motive power; and if the mechanical fixings are not present which are necessary for the setting-up of these voltaic currents no dissolution occurs. In reality, the dissolution of gold in the cyanide is analogous to the dissolution of zinc in the sulphuric acid of a Smee's cell. If means are not present for the production of the voltaic circle no pronounced, no regular, action takes place—it is merely a difference in the construction and the arrangement of the cell. Thus, in the Smee's cell it is one solution and two metals, but in the cyanide process one metal and one solution at the start, which solution, from the causes I have named, and probably others in conjunction, becomes of various strength, and so fulfils the condition necessary to insure the existence of the voltaic circle.

THE THEORIES OF DR. KEITH AND DR. HOOD.

In this connection it is proper that I note, and shortly discuss, two theories that I just learn from the second edition of Rose's "Metallurgy of Gold" have been constructed to show how the chemical actions obtaining in the cyanide process are initiated and brought about. Dr. Keith suggests, in "Engineering" for 1895, page 379, "that the action of oxygen (in this process) is due to its strongly electric negative relation to gold in the cyanide solution." Making use of Dr. Gore's table of the electro-motive power of certain metals in these solutions as compared among themselves,[*] he selected carbon for experiment to support the theory, and, as he states, found that it greatly accelerated the dissolution of gold—a fact that, twenty years before, I had stated would occur.

In regard to this supposed capability of oxygen to act the part of a negative pole—to substitute a metal—say, mercury—in the voltaic cell—I must, however, strongly dissent from him, and would remind him that oxygen at ordinary temperatures is not an electric conductor; it is therefore physically incapable of acting the part here assigned to it.

By the way, I would remark that the use of a mercuric cyanide in the potassic-cyanide solution, feasible—nay, profitable—as it should be on theoretical grounds, is not likely to be successful, and for the reason I have stated in 1895.[†] The fact is that, though the gold becomes quickly amalgamated, and there is every sign of a rapid dissolution of the gold, these are appearances only, as the deposited mercury greatly interferes with the passage of the underlying gold through it to the cyanide solution, nor, indeed, "does it," as I say, "entirely go before all the mercury thus deposited has also been dissolved." The process is really retarded instead of being accelerated by this chemical amalgamation of the gold. These statements of mine have since received confirmation as to their absolute correctness by the results of certain experiments of the author of the work on metallurgy that I quoted from (Dr. Kirke Rose, D.Sc., A.R.S.M., F.C.S., &c.).

The next theory, that of Dr. Hood, claims that the cyanodizing of gold is always effected by a displacement of another metal from the cyanide used by it—that, in fact, as he goes on to say, "pure alkaline cyanides cannot dissolve gold"—meaning, of course, in the oxygenated solution. To meet this theory I need only ask him, I think, what metal or metals are likely to be in the cyanide, or even in the auriferous mine-stuff itself, that gold could displace from a cyanide solution. The table of mine referred to only names the metals platina, iron, lead, and mercury as being negatives to gold in cyanide solutions; but certainly platina is out of the question, while iron would not be replaceable. There only, then, remains mercury and lead, and neither of these are present in cyanide solutions except on very rare occasions. But, independent of this, we know that gold absolutely pure (as prepared from its pure chloride by oxalic acid) is dissolvable by the weak cyanide. Clearly, then, this theory is disproved by fact.

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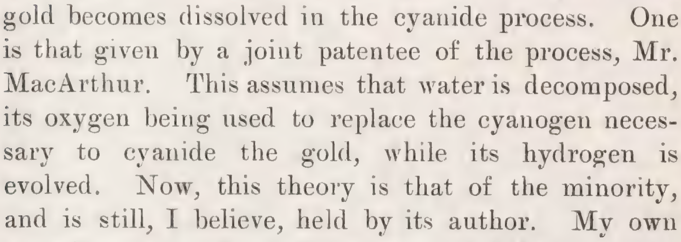
[*] My own table for this purpose was published two years before Dr. Gore's table was. The tables pretty well agree as far as they go; but, as Dr. Gore's was published in the Transactions of the Royal Society, it takes precedence over mine in the editorial mind.

[*] Twenty-ninth Annual Laboratory Report, p. 44.

The Actual Chemical Decompositions that occur in the Process.

Two theories have been formulated to explain how gold becomes dissolved in the cyanide process. One is that given by a joint patentee of the process, Mr. MacArthur. This assumes that water is decomposed, its oxygen being used to replace the cyanogen necessary to cyanide the gold, while its hydrogen is evolved. Now, this theory is that of the minority, and is still, I believe, held by its author. My own experiments in this matter gave, as I have already stated,* results entirely against it, and I have seen no reason to alter my expressed opinion in this matter—that is, as regards the practical working of the process; but by an apparently trivial and unimportant variation in cyaniding gold we actually do get a liberation of hydrogen. For this it is only necessary to so arrange that the negative gold of the cyanide apparatus (the voltaic cell, as it really is) shall be placed in an acid solution—say, in hydrochloric, sulphuric, or acetic acid. The diagram here given explains what I mean. A is a vessel containing potassic cyanide of any strength, in which is a sheet of gold-leaf (gummed to paper). B is another vessel, containing the acid in water heavily salted to drive out the oxygen that might interfere with the result. In this vessel is a gold wire d, which is connected with the gold-leaf c. Interpolar connection is completed by the bent glass tube e that is full of hydrated, but almost solid, gelatine, slightly salted for conducting purposes, if necessary.



Soon after this arrangement is set up a stream of gas may be observed issuing from the gold or platina wire. This is hydrogen, and the evolution goes on continuously till all the gold-leaf is dissolved. It is necessary to have a small cathode and a large anode to be certain of success in the experiment, as cyanodizing is at the best a slow process, and even concentrated solutions of the acids and salts let in oxygen fast enough to oxidize hydrogen to a notable extent, and thus prevent its liberation being noticed. It is a singular fact that if potash, or any alkaline solution, were substituted for the acid in B I was unable to observe any evolution of gas, yet the currents formed appear as strong as when the acid was used. It is possible, however, that potash, by its great affinity for water, so rapidly determines the oxidation of hydrogen that none is to be seen escaping.

These results, while they clearly show the unexpected fact to many that hydrogen can be liberated in a cyanide process, show just as clearly that in the process as carried on at the mines the gas is never evolved, but is, so to speak, only transferred in a liquid form to the oxygen present at the anode. The process there demands that the oxygen shall be present there and in quantity, while the alkalinity of the solutions around them favours the rapid union of this gas with oxygen before it can assume the gaseous form, or even before it can in reality become free.

It should be stated that a brisk evolution of hydrogen is afforded by cyanodizing copper, even when the anode is in an alkaline solution. This branch of the investigation requires further researches.*

The next theory, and the popular one, to explain the chemistry of the process involves the decomposition of potassic cyanide, the cyanogen combining with the gold as before, while its potassium combines with oxygen gas as present in the solution. This view appears reasonable, and, indeed, unassailable, until we take cognisance of the fact that we can, by the very slight modification in the process just described, get an evolution of hydrogen—that is, by transferring the negative gold—the negative pole—from its alkaline to an acidic solution. A careful consideration of this fact leads me to think it is not in reality the potassic cyanide but the hydrocyanic acid that is decomposed.

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* Mines Report for 1895, p. 88.

* Regarding the gold used in this experiment, I should state that it did not contain silver, copper, or iron.

We must consider that in the cyanide solution we have not the simple compound potassic cyanide to deal with, but the hydrocyanide of potash, corresponding to the hydrochloride of potash. As I have already stated, the cyaniding of gold produces electricity, thus necessitating for its continuance the presence of an electrolyte, and for this hydrocyanic acid should, I think, be as well suited as hydrochloric acid, which, as we well know, is capable of acting this part, although not so easy to decompose as the former acid. Why not, then, look upon this compound as the one that is decomposed in the process? It is true that the decomposition of potassic cyanide may also result in the liberation of hydrogen by a secondary action in which water is decomposed, as MacArthur's theory supposes; but to my mind this is hypothecating a complexity in the process that we have no necessity and no warranty for doing.

On the hypothesis I have here advanced the cyanodizing of gold is a very simple operation, or, rather, a combination of two very simple operations. The affinity of gold for cyanogen and that of oxygen for hydrogen in the presence of an alkali conjointly determine the decomposition of the hydrocyanic acid, a gold-cyanide forming at the one pole and water at the other. This constitutes the first operation. The dissolution of the cyanide by a portion of the remaining potassic cyanide is the second operation. In the first operation there is no precedence in action at either pole; the electric action at each pole commences simultaneously. True it is that to the old idea of voltaic electricity as a current (a false idea which our every-day use of old terms perpetuates) it is not easy to reconcile one's self to the thought of a simultaneous start of electricity at each pole; but by charging one's self with a full and a trusting belief in Faraday's theory, that such electricity is only a polarisation, one clearly perceives that this is the only way the action is started.

Not always the "Dilute Solution" that most rapidly attacks Gold.

A very singular phenomenon may be observed in regard to the action of the cyanide solution upon gold such as that which Professor Faraday used for his experiment. This gold is deposited from very weak solutions of its chloride by phosphorus or hydrogen* in such finely-divided particles that they are indistinguishable—in fact, invisible—under the highest-powered microscope of that time, and they are able to remain in suspension in water for an indefinite period, and it is only by reflected light Faraday could observe them. Now, if we neutralise, or slightly alkalise, this red-looking auriferous fluid (we cannot designate it as a solution), then divide into two parts, and mix one part with, say, three volumes of the dilute solution, and mix the other part with a strong cyanide solution—say, the concentrated solution—it will be found that it is the gold in the strong cyanide that first disappears from view. Nor is it a neck-and-neck affair by any means, for in the strong solution three seconds may suffice to complete the operation, while in the case of the orthodox dilute solution the time required will be about five minutes—that is, about one hundred times longer. This is, of course, just what one would have expected a few years ago, before our working cyaniders had taught us the extraordinary potency of the dilute solution over the strong solution as a gold-dissolver. Both the blue and the red gold of Faraday give these results.*

These results clearly prove that even in the supposed inert solutions of the cyanide the strong solutions rapidly act upon gold to a limited extent. It is not a matter of superior causticity, for it was found that strongly alkalizing the weak cyanide did not hasten the dissolution.

The explanation of this enigma is, I think, this: In the strong solution cyaniding goes on at once, but only so far as to produce a colourless cyanide of gold that is insoluble, or but very slowly soluble, in the liquid. I have before† shown that gold taken out of a strong cyanide solution refuses to amalgamate, or, at least, but very slowly amalgamates, showing, as I said, that an insoluble saline film of some gold-cyanide has enveloped it. In further support of this idea I would note here the fact (which may or may not have been observed before) that gold-leaf upon a strong cyanide solution, in disappearing, leaves floating thereon a pale white ghostly-looking figure of its departed self, exact to the shape, and reminding the student of ancient history of the sad metamorphosis of Lot's wife. In the case before us, however, there is no transmutation of a vast number of metals—nor even of one: the white floating mass left by the gold is its cyanide, and it is this substance that, I believe, always forms upon gold in strong cyanide solution, thus preventing or retarding its dissolution.

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* Coal-gas may conveniently be substituted for hydrogen.

* The blue gold that Faraday got by the administration of salt to the red gold reverts to the red gold in weak cyanide, also chlorine—a change that Faraday failed to produce, though he long sought for it.

† Twenty-ninth Laboratory Report, 1895, p. 45.

In the strong solution, then, we have not only the limited supply of oxygen against the cyanider, as Maclaurin has shown, but we have also the rapid enfilming of the gold by a salt that is but very slowly removed therefrom.

(*To be continued.*)

IMPROVED MINING PROCESSES.

The Bromine Extraction Process.

A SHORT description of this process was published in the December issue of the *New Zealand Mines Record*. Since then a number of reports have been received from the Gold Extraction and Bromine Recovery Company. The following particulars of the process, furnished by Mr. Horace F. Brown, M.E., to Dr. E. D. Peters, accompanies the reports of Professors Crookes and Ramsay :—

In response to your request for information in regard to the "bromine process" of gold extraction, as carried out at the Nellie Bly Mill at Boulder, Colorado, I take great pleasure in submitting the following statement, which I think will be sufficiently in detail for you to gather the general idea that forms the distinctive features of the "bromine process."

My knowledge of the practical workings of the process begins with the erection of the Nellie Bly Mill, which was built as an experimental plant, after drawings made by me.

The mill consists of the usual appliances for fine crushing with Cornish rolls, a roasting furnace, mechanical cooling-hearth, &c., arranged practically as in an ordinary dry-crushing mill for chlorination.

In addition to the barrels were solution tanks, tanks for precipitation, and columns for recovering the bromine.

The Boulder ores, as you are well aware, present some difficult metallurgical problems that have proved hard to solve. The presence of tellurium renders amalgamation impossible, and no efforts at concentration have proved successful, and the ordinary barrel chlorination and cyanide gave but meagre results. The richer tellurides were sold to the smelters, but the mass of the low-grade ores were practically worthless.

Owing to these combined difficulties, I took more than an ordinary interest in the bromine experiment, while at the same time I thought that the experiment should be made where conditions were more favourable.

The process, in brief, is as follows :—

The ore is first crushed to pass a 30-mesh screen, and is then roasted "sweet." Owing to the excess of tellurium, the roasting problem was a matter of serious concern, but after full investigation it was decided that the Brown horseshoe type of mechanical roasters was best adapted for the purpose.

The requirements were deemed to be frequent stirring, with a length of hearth that would insure very gradual heating of the charge, with a high heat at the finish. The process of roasting has proved a success, there being but a very trifling gold loss perceptible, after a most careful analysis, covering actual work for about one year.

From the roaster, the ore is carried over the Brown mechanical cooling and conveying hearth, and automatically discharged to the store-bin above the barrel.

The barrel is first charged with the required amount of 2 per cent. solution of bromine, after which the ore charge is put in, and the barrel closed and revolved for about one hour and a half. The length of time the barrel is revolved depends largely on the fineness of the mineral, and varies from one to two hours.

The solution is then forced out through the usual filter and into a store-tank in the top of the mill. Up to this point the operation is exactly similar to the chlorine process.

The distinctive characteristics of the bromine process consist in the recovery of the bromine and the refining of the gold.

There are two tanks in the top of the mill, one for the strong solution, and the other for the solution weakened by the wash-water. Beneath each tank is a tower made of porcelain pipe about 12 in. in diameter and 20 ft. high. The column connected with the strong solution tank is filled with diaphragms placed a few inches apart, and pierced with small holes. These holes are staggered, so as to break the stream of solution as it flows through as much as possible.

The column connected with the weak solution tank is filled with broken stone. The two columns are connected together at the top by means of a pipe, and at the bottom the strong solution connects with a precipitating-tank, while the other connects with a store-tank. Live steam is admitted to the bottom of the strong solution column and the solution admitted at the top.

The small broken streams of solution are quickly heated considerably above the boiling point, usually about 300 degrees Fahr. This releases all the uncombined bromine, which is carried over to the opposite column through the pipe at the top, in the form of gas or vapour. Weak solution is admitted in a quantity just sufficient to condense the vapours and to produce a 2 per cent. solution, which goes to the store-tank ready for the next charge.

This process of recovering the free bromine is very simple, and requires but little attention, the attendant quickly learning to determine the strength of the solution that passes to the store-tank by the colour.

The precipitation of the gold from the solution is accomplished by introducing finely-ground sulphide of iron, and the precipitate is passed through a Johnson filter-press to free it from excess of moisture, after which it is placed in stone tanks and re-dissolved by a bromine solution.

After settling, the solution is syphoned off to another stone jar, or tank, and nothing but pure bromide of gold passes over. This operation is repeated until tests show that no more gold is being passed. The pure gold solution is again treated with a little sulphide of iron, and the gold precipitated. This precipitate is then dried and melted, yielding a bar of C.P. gold.

This method of refining the precipitate is exceedingly simple; it requires but little attention, and there are no impurities to form slag, reducing the bulk to so small a limit that it is easily handled, even in a large mill. The material left in the first tank after syphoning off the gold consists of silicious matter, tellurium, bromo-sulphur compounds, &c.

The bromine from all these compounds is liberated by washing with a small amount of chlorine, making a complete recovery within a very small percentage of all the bromine.

About all the loss that is sustained in the whole operation is the exceedingly small amount of chloride of lime and acid to form chlorine gas sufficient to free the combined bromine, amounting probably to less than 1 per cent. of the loss when chlorine is used instead of bromine, as in barrel chlorination.

The above is a description of the process as first used, but subsequent improvements have simplified the process, especially as to the mechanical appliances, so much as to revolutionise the whole mechanical arrangement.

The chief objection to bromine is the exceedingly pungent fume, necessitating the employment of closed vessels during the whole operation, causing great expense in shipping and handling.

The improvement developed during the past year consists of a process of changing the bromine to an odourless alkaline salt which can be shipped in sacks or boxes with no more risk or expense than shipping common salt, and without loss by volatilization.

This bromo-salt forms odourless solutions that can be used in an ordinary open leaching-tank, the same as cyan- or hypo-solutions, and retains all the remarkable properties of a gold-solvent belonging to bromine as usually used. The recovery of the bromine from the alkaline solutions is virtually as described above.

You will readily understand the advantages of being able to use the solutions in open tanks * without loss or discomfort, as well as the great saving in first cost of a plant and the saving in power.

I suppose there are ores where the gold would be too coarse for profitable treatment by bromine, as, like all solvents, it works comparatively slow on coarse particles of gold. Should there be some coarse gold in the ore that would require too much time to become completely dissolved, the tailings can be run over silvered plates and a complete recovery made, as gold coated with bromine is very susceptible to the action of quicksilver.

Where the alkaline bromo solution is used this can be done without any discomfort, as there is no odour as would be in the case of chlorine. Bromine solutions act but slowly on silver, a bromide coating quickly forming that arrests solvent action, but a bromide of silver is easily amalgamated, and I believe that the silver in mixed ores can be recovered very successfully by amalgamating the tailings, and with but a trifling expense. This is, however, but a theory, as I have not made or seen any tests to determine this point, there being no silver in the ores that are being worked in the Nellie Bly mill.

As to the necessity of roasting, I believe it is as much for the purpose of calcining the clays associated with the ores to destroy their cohesive qualities as for the purpose of eliminating the sulphur, but at least there is no more necessity of roasting than there is with cyanide or chlorine.

The use of mechanically stirred reverberatory furnaces has reduced the expense of calcining ores to so low a figure that it is no longer a question to be considered, the advantages of rapid percolation more than overcoming the small cost of calcining, and the increased extraction adding largely to the percentage of profits.

With the development of the alkaline bromo-salt it has become possible to adapt the bromine process to existing plants where open leaching-tanks are used, the only expense required being to put up the necessary means of recovery, which would be but trifling.

Having assisted in designing and building the experimental mill, which has a capacity of 25 tons per day, I have had a great interest in the outcome, and during my frequent visits to the mill I have taken pains to examine the records of extraction, and to get posted with all the conditions *pro* and *con.* affecting the practical working of the process, and am free to say that I am charmed with its simplicity and effectiveness, and its apparent adaptability to all low-grade gold-ores.

The records of regular mill work, covering several months and several hundred tons, show a saving on the difficult ores of Boulder County that will average up with the record of the best mills which I know, working much less complex ores, and under more favourable conditions.

The development of the alkaline bromine solution, and its proved efficiency, has removed all the objections I could find against the bromine process.

The process has been developed by the joint skill and efforts of Mr. Harry Cassel and Mr. Bertrand C. Hinman.

PUBLICATIONS RECEIVED.

"The Mineral Industry of Tasmania," compiled by J. Harcourt-Smith, B.A., Geological Surveyor of Tasmania. From the Mines Department.

"Report on the Cassel-Hinman Process for Extracting Gold from its Ores," by Sir William Crookes, F.R.S., Professor William Ramsay, F.R.S., and others. From the Gold Extraction and Bromine Recovery Company, London.

"Interim Report: Mineral Resources of the Colony: the Gold Yield of Western Australia." From the Perth Chamber of Mines.

"Mineral Statistics of the United Kingdom of Great Britain and Ireland, with the Isle of Man, for the Year 1896."

"Experts' Report and Treatise on Coombes' Dry-mining Machine for the Extraction of Gold and other Minerals."

"Report of the Royal Commission on the Working of Mines and Quarries in the Albert Mining District, N.S.W." From the Under-Secretary for Mines, Sydney.

"Reports by the Government Geologist in connection with the Water-supply of the Goldfields." From the Mines Department, Western Australia.

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* The vendors point out that by the use of open tanks, now available (and as above indicated by Mr. Brown), the disadvantages of the barrel system are entirely obviated.

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THE

New Zealand Mines Record.

JANUARY 17, 1898.

[Issued by the Mining Bureau of the Mines Department, New Zealand, under the authority of the Hon. A. J. CADMAN, Minister of Mines.]

NOTES AND COMMENTS.

THE gold and silver entered for export at the Customs during the month of December, 1897, was as follows:—

Ports.	Gold.		Silver.	
	Oz.	£	Oz.	£
Auckland	7,694	26,946	17,522	1,917
Westport	643	2,572	..	..
Dunedin	612	2,449	..	..
Invercargill	1,514	6,057	..	..
Totals	10,463	38,024	17,522	1,917

The following table shows the gold and silver exported during the past two years:—

—	1897.		1896.	
Gold—	Oz.	£	Oz.	£
Quarter ending March 31	69,621	275,816	76,402	301,502
" June 30	60,046	233,928	44,208	173,502
" Sept. 30	60,222	232,844	76,051	302,974
" Dec. 31	61,755	237,615	67,033	263,450
Totals	251,644	980,203	263,694	1,041,428
Silver	181,160	20,586	94,307	10,589

From 1st January, 1857, to 31st December, 1896, the Customs returns supply the figures for the gold and silver entered for export at the various ports of the colony as follows:—

	Oz.	Value.
Gold	13,313,907	£52,392,430
Silver	901,270	181,852

During the past forty-one years, 1857–97, there was exported:—

	Oz.	Value.
Gold	13,565,551	£53,372,633
Silver	1,082,430	202,438
Totals ..	14,647,981	£53,575,071

Or an average of about £1,306,709 per annum. A comparison for the forty-one years will be interesting:

Year.	Gold.		Silver.	
	Oz.	£	Oz.	£
1857 ..	10,437	40,422	..	..
1858 ..	13,534	52,464	..	..
1859 ..	7,336	28,427	..	..
1860 ..	4,538	17,585	..	..
1861 ..	194,031	751,873	..	..
1862 ..	410,862	1,591,389	..	..
1863 ..	628,450	2,431,723	..	..
1864 ..	480,171	1,856,837	..	..
1865 ..	574,574	2,226,474	..	..
1866 ..	735,376	2,844,517	..	..
1867 ..	686,905	2,698,862	..	..
1868 ..	637,474	2,504,326	..	..
1869 ..	614,281	2,362,995	11,063	2,993
1870 ..	544,880	2,157,585	37,123	11,380
1871 ..	730,029	2,787,520	80,272	23,145
1872 ..	445,370	1,731,261	37,064	9,910
1873 ..	505,337	1,987,425	36,187	9,850
1874 ..	376,388	1,505,331	40,566	10,380
1875 ..	355,322	1,407,770	29,085	7,569
1876 ..	322,016	1,284,328	12,683	3,171
1877 ..	371,685	1,496,080	33,893	7,556
1878 ..	310,486	1,240,079	23,019	5,755
1879 ..	287,464	1,148,108	20,645	4,512
1880 ..	305,248	1,227,252	20,005	4,500
1881 ..	270,561	1,080,790	18,885	4,236
1882 ..	251,204	1,002,720	5,694	1,286
1883 ..	248,374	993,352	16,826	3,785
1884 ..	229,946	921,797	24,914	5,125
1885 ..	237,371	948,615	16,624	3,169
1886 ..	227,079	903,569	12,108	2,946
1887 ..	203,869	811,100	20,809	3,453
1888 ..	201,219	801,066	403	71
1889 ..	203,211	808,549	24,105	4,043
1890 ..	193,193	773,438	32,637	6,162
1891 ..	251,996	1,007,488	28,023	5,151
1892 ..	238,079	954,744	22,053	3,996
1893 ..	226,811	913,138	63,076	9,743
1894 ..	221,615	887,839	54,177	6,697
1895 ..	293,491	1,162,164	85,024	10,679
1896 ..	263,694	1,041,428	94,307	10,589
1897 ..	251,644	980,203	181,160	20,586
Totals..	13,565,551	53,372,633	1,082,430	202,438

There is a decrease in the gold yield for 1897, as compared with 1896 and 1895. This must be set down to the fact that some of the biggest mining properties, in which large sums of money have been invested by British, German, and French capitalists, are being opened out in a thoroughly systematic manner. At Coromandel, Thames, Ohinemuri, and Te Aroha, in the Hauraki Mining District; at Reefton, Westport, Addisons, Charleston, Taitapu, and Parapara, in the Westland and Nelson Mining Districts; at Barewood, Macetown, and Skippers, in the Otago Mining District, many of the largest mines are being worked more with the view to the future than present returns. This year there will be a considerable addition to the number of stamps at the quartz-mills on the various fields, and important works such as those carried out by the General Exploration Company near Westport, and the Parapara Hydraulic Sluicing Company near Collingwood, must add considerably to the alluvial gold yield for 1898; while, if the large fleet of new dredges projected in Otago should chance to have as good locations as most of those that have been dredging the beds of the rivers in Otago for some years past, renewed prosperity must be the outcome in that portion of the colony. Although British and foreign shareholders may feel a little impatience at the lack of bullion or dividends from some of the companies in which they are interested, they will in the course of a year or two see the wisdom of having their mines opened out in a systematic manner, with a view to their more permanent and economical working. The year 1897 opens with good prospects for the gold-mining industry. The boom and the feverish excitement have died away; hundreds of claims that should never have been pegged-off have been abandoned; but from Preservation Inlet, in the South, to the Great Barrier, in the North, good work is being done, and gold-mining is being placed upon a more satisfactory and solid footing as one of the permanent industries of the colony.

The Inspecting Engineer paid a visit to Mount Peel last month for the purpose of inspecting the opal workings, which were reached by the road up the Rangitata Gorge, behind the mountain, an ascent of 2,800 ft. having to be attained in less than two miles. The workings, which are 4,280 ft. above sea-level, consisted of a paddock about 20 ft. in length, sunk on the slope of the hill, the upper end being about 2 ft. in width, and at the lower end, where the width was 6 ft. to 8 ft., it was excavated to a depth of 7 ft. About 50 ft. lower down the hill an open cutting 12 ft. in width was made, but no signs of opal matrix had been met with. At a further distance of four chains small opals were being got by picking down the rock where they were visible, and in that way a number of pieces were obtained, but too small to be of value, although the scintillation of red colour was readily seen in most of them. On a blast being fired by Mr. Lyons, the manager, who had prepared it while Mr. Wilson was inspecting the other workings, a piece of the matrix about 15 lb. in weight was found in the *débris* containing an opal of roundish form and bluish colour, and another piece of opal showed in a stone near the bottom. The specimens were handed to the Inspecting Engineer, though the manager reluctantly parted with the first one, stating that, as wages were owing to him, he meant to keep that stone for himself. A variety of crystals and stone of opaline character could be seen on the surface of the mountain, and a few specimens were collected. The matrix or rock in which the opals exist is a kind of reddish-brown and apparently igneous rock, extending in a run between the paddock and the face where the small opals were found. It did not appear to be very wide, and, as far as could be discovered was about a foot across and nearly vertical. The whole of this could, at very little cost, be stripped to a depth of several feet from the paddock to the face, and thus give about four chains of matrix that could be thoroughly searched for opals. At several points on the way down from the mountain top—the descent being made by following a pack track which led to the flat about two or three miles further up the Rangitata Valley than the point where the ascent commenced—rock of the same character as the matrix was found in the workings. From the character of the loose stone found on the surface, from the evidence of small opals at the face, and from the nature of the results from the paddock, it could be assumed that a considerable area containing opaline stone exists, and further search may probably prove that other parts of the mountain contain stone of opaline character. In Queensland, according to the annual report of the Under-Secretary of Mines for that colony, "the opal mining industry is confined to the cretaceous areas in the far west and south-west of the colony, where this gem is met with at a few feet from the surface down to 40 ft. It occurs as a rule in bands or beds that deviate very little from the horizontal, and which at one time formed the bottom of shallow inland seas. There is probably more hazard in the chance of striking a good opal deposit than dropping across a chute of gold; but as the majority of men engaged in this industry follow it only in spare time between other occupations, such as station work, they come doubtlessly prepared to put up with whatever luck may fall to their share." The Mount Peel field might be worked under similar conditions, and it was suggested that after the shearing season was over many of the men engaged in that occupation would probably give the opal field a trial. As the distribution of opals is uncertain, and the stone only found in small patches, careful examination only will prove whether valuable deposits are to be found or not. As the work would chiefly be with pick, shovel, and wheelbarrow, no great amount of capital is at present required to make a thorough test of the field. The Record Reign lease, which was inspected, contains an area of 60 acres, and about £100 has been expended by the lessees; but very little, if any, work has been done on the other eight leases, which comprise an area of 172 acres and 17 perches. A long stretch of the matrix can be readily and inexpensively examined in the Record Reign ground, and, as the mountain will be clear of snow for several months, a thorough search may be made during the summer, especially as labour will be plentiful after the shearing season is past. The value of the opals must first be determined, and sufficient quantity won, before any one can pronounce whether or not opal mining can be profitably carried out at Mount Peel. There is no reason for further delay in proving the field, and the lessees can readily employ the necessary labour, provided they are prepared to undertake the expenditure required. If valuable opals are produced, the success of the industry will be ultimately assured, failing which the field should be left to the prospector.

The farmers of Berwick, in Otago, who are contemplating the formation of a River Board in that district, for the purpose of contending against the encroachments of the Waipori River, which they allege is caused by the silting up of the river-bed, the result of dredging operations at the Upper Waipori, and have asked what assistance the Government would be willing to offer in the event of their forming a Board. A reply has been sent, to the effect that the Government are prepared to render every assistance to any reasonable proposal that may be submitted for consideration, but the settlers themselves must take the initiatory action in the matter, and when submitting their proposals they must bear in mind that, as they have already received compensation for damages that may be caused to their properties by mining operations, they have no further claim upon the Government on that account.

A case of some interest to the mining community came before his Honour Judge Conolly at Auckland last month. It was an appeal from the decision of Mr. Warden Bush at the Thames, in a case in which James Jordan, Mining Registrar, sued Peter Norbury for £21 5s., rent due in respect of the second part of the first year's rent of the Guiding Star Special Claim, calculated at the rate of 10s. per acre. Mr. Brookfield, who appeared for the appellant, contended that it should be at the rate of 5s. per acre, as provided for by section 36 of "The Mining Act Amendment Act, 1896." The license was consented to on the 22nd September, 1896. The notice was dated the 7th October, 1896, the first rent was paid on the 6th November, 1896, and the rent sued for became due on the 22nd March, 1897. Mr. Tole, who appeared for the respondent, pointed out that the Act was not in existence till the 17th October, a month after the license was entered, and the rent was due and payable on the day that the Minister consented to the license. Mr. Brookfield said he did not claim that the Act was retrospective. It was clearly the intention of the Legislature that during the first year the rent should be less. His Honour was quite clear that the Warden was right in his decision. It was clear that before the Act of 1896 came into force there was a contract and agreement for the specific payment of a sum of money. He must hold that the Act of 1896 only applied to licenses made after the passing of the Act. The appeal was dismissed. The decision will tend to settle a disputed point, as the appeal was regarded as a test case by many who had taken up claims about the same period as Mr. Norbury.

His Excellency the Governor intends to take a driving tour through the goldfields during the month of February. Messrs. Craig and Co. will provide the conveyances and horses, and the tour will be under the personal supervision of Mr. Hugh Craig. A very attractive route has been mapped out, by which the vice-regal party will be enabled to see the best of the Southern lake scenery and the most interesting of the goldfields' districts. The route as at present intended, subject to subsequent alterations, is as follows: The party will reach Queenstown by the Waimea-Kingston Railway, and from Queenstown will go to Skippers, returning same evening; Queenstown to Arrowtown, *viâ* Lake Hayes; Arrow to Pembroke, *viâ* Cardrona; two days' stoppage at Cardrona, which will give an opportunity to drive to Matukituki and to boat on Lake Wanaka; from Pembroke to Cromwell, thence to Clyde or Alexandra; from thence to Roxburgh, and from Roxburgh to Lawrence. Lady Ranfurly will not accompany the party.—*Mount Benger Mail.*

The Tuapeka correspondent of the *Otago Witness* writes: "The Golden Rise commenced another paddock on the 3rd December. They had just got their boxes up on the 27th November, when it came on to rain heavily. That evening the creek broke in on them and flooded their paddock. All the elevating castings and the pipes were in the paddock. It took over two days to pump the water out, going night and day. The water was removed on the inverted syphon principle: a jet of water going through pipes draws the water up with it. This saves expense and room, by doing away with a tail-race. The principle is only suitable for shallow and not very deep ground."

The Inspecting Engineer recently visited Cullensville, in Marlborough, for the purpose of reporting on a dam and fluming proposed to be constructed at Mahakipawa Creek, for which a subsidy was asked. The dam is designed to be constructed in such a manner that all the water at present flowing through the gravel composing the bed of the creek will be entirely retained by it, conducted in a flume along the banks of the stream, and run into a race owned by the King Solomon Company. The scheme would undoubtedly prove a benefit, by enabling the ground affected to be worked at less cost, the wet nature of the gravel overlying the bed-rock having been hitherto a serious obstacle. The workings under the creek bed have been, in consequence of the water contained in the ground, carried on in such a manner in the past that it is said a considerable quantity of gold yet remains, which it may be possible to recover if the cost of hauling the water can be done away with, or to a very great extent lessened; but sufficient evidence had not been adduced to show that enough gold would be recovered to pay for the cost of working the ground and the construction of the dam and flume. One claim only, the King Solomon, was at work when the district was visited. The remainder of the creek was deserted, up as far as the Forks, about three miles from the King Solomon Mine, although a few fossickers were working higher up the creek. With the exception of fifteen claims between the dam and Cullen's Freehold, the whole of the lead that would be advantaged by the construction of the dam is situated in private land. Neilson and party hold several claims on private land; in fact, all the lead between the freehold boundary and the King Solomon Mine appears to be claimed by them. The scheme, as far as the ground to be worked near the proposed dam is concerned, is simply for the purpose of fossicking and reworking a portion of the lead from which the greater portion of the gold has been already taken out. Until it can be clearly shown that a sufficient number of miners are willing to take up and work the ground with a reasonable prospect of success, the expenditure of £395, the estimated cost of the dam and flume, could not be recommended. The water cannot be stored in any way, and if used for sluicing would again run back into the bed of the creek and find its way through the gravel to the bottom.

A letter, forwarded by the Hon. Mr. Larnach from Mr. David Lamb, Waikaka, complaining of the disadvantages under which miners labour in connection with the endowments of the Otago School Commissioners, between Pomahaka and Waikaia, has been referred to the Commissioners, who state that "a considerable portion of the area referred to has been brought under the provisions of the Mines Act, and is therefore already under the sole jurisdiction of the Warden. The Commissioners have no desire to prevent the development of mining so long as the interests of their trust are conserved, in proof of which they have recently granted the right to cut very extensive water-races through the lands referred to by Mr. Lamb, notwithstanding the fact that the existence of water-races is a serious detriment to the management of the runs. As far as timber is concerned, the Commissioners became aware that the settlers and others outside of the endowment were in the habit of cutting and removing fencing and other material from the Leithen Bush on Run 202, and in order to prevent the destruction of much valuable timber, and protect the interests of the tenants of the endowment, they appointed a ranger to look after this and other bushes in the neighbourhood, by collecting a fee for timber before its removal from the ground. The area of the endowment in the district is considerable, and sooner or later a great deal of fencing material will be required by the Commissioners' tenants. It is therefore necessary to put some restriction on the removal of timber. The rate of fees is very low, viz.: 4s. per 100 for fencing posts, 6d. each for heavy strainers, 2s. per 100 for stakes, and 1s. per cord for firewood." The Commissioners, in conclusion, state: "It will thus be seen that miners can obtain what they require, and that the hardship complained of by Mr. Lamb does not exist. Mr. Lamb has never applied for any mining rights from the Commissioners."

John Dixon, timberman at the Wealth of Nations Quartz-mine, Reefton, sustained concussion of the spine through falling down the shaft, on the 6th ultimo, a distance of 150 ft. Prior to the accident three men—George Hufton, carpenter, John Dixon, timberman, and Andrew Patton, miner—were at work putting in guides in the new shaft at the 350 ft. level, below the battery-level. Having completed this work, a portion of a centre- or lining-board had to be removed near the bottom of the 500 ft. level, and John Dixon got into the temporary cage or platform, which was 9 ft. long, securely braced by a wire rope, and made so strong that it was not broken by the fall, the uprights having to be sawn before Dixon could be got out. The officer who was sent to report stated that had the handle been used instead of the brake in lowering the cage or platform it would have been almost impossible for the accident to have occurred, as the platform nearly filled the whole of the compartment, and the crab-winch used for raising or lowering it appeared to have been in first-class order and repair. The statements of the men concerned went to show that the mine-manager had cautioned the men against the use of the brake, and Hufton admitted having ordered Patton to use the brake against the orders of the mine-manager. After consideration of the report, and statements made by the men, the Government issued instructions that proceedings should be instituted under section 330 of "The Mining Act, 1891," against both Hufton and Patton for not ceasing to use the brake, which was considered unsafe, after being cautioned by Allan, the shift boss; and also against the manager for not providing an effective brake, as required by subsection (22) of section 323 of the Act; but, as the manager intended that the men should only be lowered by hand, the offence could not be attributed to "gross negligence." The Crown Prosecutor at Greymouth was instructed to take proceedings in the law-courts.

INQUIRIES have been recently received by the Mines Department from ore buyers in Hamburg, Melbourne, Sydney, and Wellington about antimony, wolfram, molybdenite, scheelite, and manganese ores, for which there is a demand. The correspondents have been referred to Mr. McKay's report on the occurrence of wolfram in New Zealand, which can be found at page 74 of the "Geological Reports" for 1888–89, and to Sir James Hector's report on manganese, which appeared the year following. Copies of the "Geological Reports" can be obtained from the Government Printer, Wellington, at half a crown for each volume. For general information, it may be stated that antimony occurs at Endeavour Inlet, near Cook Strait, and considerable quantities of star antimony of good quality were exported from there some years ago. Antimony occurs at the Taieri River, Otago, near Barewood, and at the Carrick Range, in Central Otago. At Reefton, on the West Coast, there is abundance of antimony in connection with auriferous quartz; and at the Bay of Islands, in the north of New Zealand, there is an antimony lode. Wolfram is mainly found at Stewart Island, in connection with tin. Molybdenite occurs at Caswell Sound, in connection with limestone Manganese ores have been found in many parts of the North Island: at Waiheke and Kawau Islands, Puerua Bay, Helena Bay, Mangapai, Hikurangi, Hawke's Bay, and Wellington; also near Port Hardy and D'Urville Island, Nelson. Braunite (manganese oxide) on Malvern Hills, Canterbury; and rhodonite (silicate of manganese) at Dunstan, Otago.

A REPORT has been received on two accidents which occurred last month—one at the Kauri Freehold Gold Estates Mine, at Opitonui, to a miner named Adam McConnell, who had his leg broken through a piece of quartz slipping out at the side of the drive close to the face where he was working; and the other at the Waihi Company's shaft, where a trucker named Albert Whitley had his arm broken. The drive in which McConnell worked was in a distance of 28 ft. from the engine-shaft at the 135 ft. or No. 1 level. The rock slipped off a mineral seam, and could not be seen until it fell out. No blame could be attached to any one, as the drive was well timbered up to within 8 ft. of the face. At the Waihi Mine, Whitley, whilst taking a full truck to the shaft, met his mate Ferguson with empty trucks at a place where they could not pass, and Ferguson helped to push the empty and full truck back to a flat sheet to enable them to get the trucks past. There is a quartz pass about 10 ft. on the western side of the flat sheet. This Whitley did not happen to notice, and, as his elbow was outside the truck, it came in contact with the mouth of the pass with such force that he had his arm broken; but the accident was of such a nature that blame could not be attached to those in charge.

A REPORT has been received of the circumstances attending the accident which befel James Hamilton, a married man, aged forty-seven years, on the 3rd ultimo, whilst working at the Iron Bridge Mine of the Denniston Collieries, the property of the Westport Coal Company (Limited). Hamilton and McCaffery, his mate, were employed at pillar-work on the section known as the flat seam. The average thickness of this coal is about 20 ft., 12 ft. of which is worked. In consequence of a shot missing, and it being the rule not to permit men to go back on the same day to a place where a missed shot has happened, the men were sent to fall loose coal in one of the bords in the section where they usually worked, and, while in the act of filling a tub, a fall of coal took place, dropping on to the heap they were filling from. A portion of the coal skid down the heap, colliding with and throwing Hamilton down, and rolling on to him with such force that the knee-cap and small bone of his left leg were broken. The place was well timbered, and the men apprehended no danger, Hamilton stating that he had examined that part of the coal which came away half an hour previous to the occurrence, and felt satisfied as to its being secure; but the fall disclosed a "lay-back," which accounts for previous warning not being given. Hamilton does not attach blame to any one, and his statement was confirmed by his mate McCaffery.

A youth named William Cain met with an accident at the Westport-Cardiff Coalmine on the 4th ultimo. He was employed at the termination of the endless haulage-road, which in that portion has a dipping inclination of 1 ft. to 6 ft. for a few chains, and, while hooking the loaded tubs on and taking the empties off the rope, one of the clip-chains broke, the loaded truck bounding back, striking Cain between the shoulders, and knocking him down. There were two stopes on that part of the road for the purpose of throwing the trucks off the rails, but neither of them took effect at the time. To prevent accidents of this kind, the Inspector who visited the mine recommended that the system of stop-blocks in use on the Westport Company's inclines be adopted. This consists of a block which is kept lying on the rail, with a spring behind it, the wheel of the tub pushing it back when passing. The suggestion has been adopted.

The annual report of the Otago School of Mines states that, "with the exception of a small lot of tailings treated by the cyanide process and the berdan, close towards the end of the past session, the testing plant was not in request by the public for many months—quite in contrast to its nearly continuous employment during the previous year. The chief cause of this unsatisfactory state of affairs is doubtless the boom in gold-dredging enterprises, in consequence of which quartz-mining and prospecting for auriferous quartz reefs, for which testing of samples is nearly exclusively required, have suffered to a great extent. There is, however, another circumstance that certainly contributed to it—viz., the general opinion amongst Otago mining men that our charges for treatment are much too high. Mr. Stevens has, indeed, evidence that several parties, after ascertaining our charges (which are on a par with the Thames School of Mines) sent their test samples to Sydney, N.S.W., where there is a Government testing plant, and that the treatment charges per ton there made, together with all expenses for transport, &c., came to less than our charges for treatment only would have to come to for the same samples. It is therefore a matter for consideration by the Mining Committee of the Council whether our charges per ton might not, without loss, be so far reduced as to equalise them with the total expenses entailed by having samples tested in Sydney."

A slate quarry is being opened on the Moeraki Run, near Mount Dasher Station, Otago, by Mr. McKay. The slate, which extends a considerable distance, is of a blue colour, and can be split in layers varying from an eighth of an inch to several inches in thickness. It appears to be of a character suitable for roofing and many other purposes for which slate is used. The Inspecting Engineer, who visited the quarry, brought some samples of the slate to Wellington, and these can be seen by builders and others who may wish to examine them. The quarry is situated about half a mile from Mount Dasher Station, and twelve miles from Maheno Railway-station. By constructing a road for a distance of a mile and a half Mr. McKay stated that the quarry could be brought within eight miles of the Herbert Railway-station. In North Wales the slate industry is an important one, most of the slates required in Great Britain being quarried there. In the "Mineral Statistics of the United Kingdom," it is stated that the total quantity of slates produced in 1896 was 586,933 tons, valued at £1,338,256. In the same year Great Britain exported 30,439,000 roofing slates, the value of which is set down at £190,984.

The Mountain Hut Water-race, which has been constructed by parties of working miners under exceptional difficulties, is now carrying 6⅓ heads of water; but the Inspecting Engineer, who lately visited the race, reports that 128·67 chains of syphon-pipes are required to convey the water to the field: the first syphon at Thompson's Creek, 12·88 chains, with depth of gully, 70 ft.; the second, at Thompson's Saddle to Paterson's, 8·29 chains, depth 42ft.; the third, depression in front of Paterson's house, 44·96 chains, depth 100 ft.; the fourth, Maerewhenua, left-hand branch, 62·54 chains, depth 721 ft.

An application for assistance towards developing a coal-deposit near Whangaroa Harbour has been received from Mr. Joseph Hare, jun., Kaeo. Mr. Hare has been informed that the department has no authority for assisting in the development of coal measures on private lands. The assistance granted at Kawakawa, to which Mr. Hare referred in his letter, was given under exceptional circumstances in connection with the railway; besides, the coal which is being worked is on Crown lands.

Professor Ulrich, director of the Otago School of Mines, in his annual report, says: "Regarding past students of whose careers I received reliable information, mostly by letters from the respective past students themselves, I may mention the following: P. Fitzgerald, our former lecturer in metallurgy, is in a good position as travelling expert for a mining syndicate at Kalgoorlie, Western Australia. Edward Paterson, formerly in a good position in the Transvaal, is now consulting expert for an English mining syndicate in Auckland, New Zealand. D. Matheson and H. C. Boydell are in charge of large gold reduction works at Tamworth, New South Wales. P. Morgan has received the appointment of director of the Waihi School of Mines, while his former position of assistant lecturer at the Thames School of Mines has been obtained by W. A. MacLeod, one of the students who left our school last year. Of other students who left last year, H. Stephens and A. Mosley have been successful in obtaining well-paying responsible positions in gold-reduction works in New South Wales; while Thomas B. Wayne, D. V. Allen, F. D. H. Ulrich, and Murray Russell hold in this country positions of assayers and assistants to managers at moderate salaries, yet affording them great advantages in learning mining work and management. S. T. Brugh, who continued his studies for the B.Sc. degree in the New Zealand University, will probably attain this coveted honour before long, as he has already passed the first section of that degree. Thomas Esdaile is manager of the cyanide works at the South Star Mine, Ballarat, Victoria, where, by profitable judicious treatment of very poor quartz-tailings, he is making quite a name for himself, and the main items of which deserve mention."

Prospecting licenses have been granted to Peter Laing, Dunedin, Walter Taylor, Roslyn, and Frederick T. Poole, Kaitangata, over the foreshore, Coast Survey District, Otago; E. P. Willcocks, Dunedin, over Crown lands in the Whangamoa district, Nelson; Edward Mallory, Hastings, over lands in the Ruahine, Ruataniwha, and Makaretu Survey Districts, Hawke's Bay; William H. Robins, Gore, and James Anderson, Invercargill, commencing at the forks of the Waiau and Wairaki Rivers to the south, taking the Waiau River and shores of Lake Te Anau to the west, the Wairaki River at the base of the Takitimo Mountains as far as the northern boundary of the Takitimo district to the east, and thence to the head of Lake Te Anau to the south; and to Moffitt and Longshaw, Waikaia, for lignite.

The accident at the Westport-Cardiff Colliery to James Marshall, overman, who had the small bone of his right ankle fractured on the 22nd ultimo, has been reported on. Marshall was assisting to lift a loaded tub of coal on to the rails at a level curve on the main haulage road, but did not ascertain the true position of the ropes on the curve wheels between the rails when he lifted the tub. It was afterwards found that the haulage-rope had been bearing hard on the tub-wheel, the heavy tension strain causing it to spring inwards to the centre of the two roads when liberated by the tub, and Marshall's foot being in the way, was caught by the ankle, the small bone of which was broken. It was the duty of Marshall, who attaches no blame to any other person, to fully ascertain the position of the rope on the curve wheels before lifting the loaded tub.

The balance of subsidy (£114 15s. 9d.) for prospecting operations at Redman's Creek, Boatman's, has been made available for Cornwall and party, at whose request the subsidy was previously discontinued, as the party were under the impression at the time that they had struck permanent and payable washdirt, which, however, turned out to be a narrow run of no value. On the strength of the find, the party erected machinery, constructed a dam, and brought in water, which required to be flumed 30 ft. high; but when they opened out they found it was not payable. They have been working at it two years, and have a few more hundred feet to drive.

"On the whole, I am inclined to think there is a slightly improved tone this week in the London market for New Zealand mines," writes the London correspondent of the *New Zealand Herald*, on the 27th November, "but it is difficult to state any specific facts in support of this idea. . . . Just now a strong feeling exists in the city in the direction of using every effort to discover some cheaper and more efficacious method of extracting gold from the ore than is afforded by the present cyanide process. I hear that inducements have been offered to certain scientists to take this matter earnestly in hand, and that experiments are actively proceeding with the view of discovering some new process which shall practically revolutionise gold-mining so far as concerns refractory and low-grade ores. Sanguine hopes are entertained that these experiments may have a favourable result. It is greatly to be wished that such may prove to be the case, as this would inaugurate an entirely new era in the mining industry of the colony."

News has been received by cable of the death of the Hon. William Gisborne, at Allestee Hall, Derbyshire, in his 73rd year. The deceased gentleman was the first Cabinet Minister who held a portfolio for the Mines Department in New Zealand. He represented Totara, a West Coast constituency at that time, in the Legislative Assembly, having been elected in 1877, and held office as Minister of Mines and Immigration in the Grey Ministry from July to October, 1879. In the latter part of 1880 Mr. Gisborne retired from politics, and since then resided in England, but continued to take an active interest in all that concerned New Zealand. In 1886 he was appointed a member of the Commission on the Colonial and Indian Exhibition. Mr. Gisborne contributed some valuable additions to colonial literature. A second edition of his well-known work, "New Zealand Rulers and Statesmen," was published recently, and fully brought up to date. The deceased gentleman, who belonged to an old Derbyshire family, came out to the colonies early in his career. After residing several years in South Australia he came to New Zealand in 1848, and obtained the appointment of Commissioner of Crown Lands at Auckland. Promotion in 1853 gave him the Under-Secretaryship of the Colony, which he held till 1869, when he was called to the Legislative Council and joined the Fox-Vogel Ministry, in which he held office as Colonial Secretary from 1869 to 1872, and during part of this period he sat in the Lower House as member for Egmont. In 1872 he was appointed Commissioner for the newly-established Government Life Insurance Department, which office he held for five years. The late Mr. Gisborne was brother-in-law to Commander Edwin, R.N., Weather Reporter for the Marine Department, New Zealand.

A company will shortly be brought out for public subscription for the purpose of acquiring and working as an industrial business a body of gold-bearing ore, which is said to be the largest in the known world—undoubtedly the largest owned by one company. The property was secured several years ago on behalf of English purchasers, and over six years have been spent upon development work in order to thoroughly prove its value and resources before issuing the shares for public subscription. Since the completion of the development work the property has been personally examined by well-known London and other engineers, who compute the available quantity of ore at upwards of 10,000,000 tons. The ore is on the slope of a high mountain, and the vast quantity rises to an elevation of 2,000 ft. above the battery-site; it is thus obtainable for crushing without the usual expense of either sinking, hoisting, or pumping. It is proposed to work with a battery of 250 stamps, and the quantity of ore is sufficient to keep this large number of stamps at work day and night for fifty to a hundred years. A perpetual water-power, with a vertical fall of 400 ft. upon the battery-site, has been constructed, and belongs to the property; this supplies sufficient power to drive all the machinery practically without cost. Many hundreds of tests prove the value of the ore on a working basis to be about £1 12s. per ton throughout the entire mass, and with the extraordinary facilities for working the operating expenses are found to be well covered at 5s. 6d. per ton. Upon a very moderate basis as to profits, much lower than the above figures would indicate, the dividends on the shares are estimated at a minimum of 30 per cent. per annum.—*Mining Journal* (London).

Application has been made for a prospecting license on the Patua Ranges, near Oakura, Taranaki, but as the land referred to is a portion of the West Coast Native Reserves administered by the Public Trustee, and has not yet been exchanged for Crown lands, the license cannot be granted till such time as the exchange is effected. In the application it was stated that that "the assay of stone from the outcrop gave 2 dwt. 12 gr. of gold, and about the same of silver." On several occasions prospectors have been at work in the vicinity of Oakura, and small finds of gold were reported many years ago from that neighbourhood.

In a pamphlet on the "Mineral Industry of Tasmania," Mr. J. Harcourt-Smith, Geological Surveyor for Tasmania, states that "in many cases the mere presence of traces of copper has been sufficient to warrant the flotation of companies, and much harm will be done to the industry by the foisting of so many 'wild cats' on the public. . . . For the last few months there has been a regular 'boom,' especially in the West Coast mines, and it cannot be denied that advantage has been taken of this to float companies for purely speculative purposes, which all true friends of the mining industry must deplore."

According to the last annual report of the Queensland Mines Department, the value of opals obtained during the year is set down at £23,300, but absolute correctness for these figures is not claimed, and it is stated that "in all probability this figure is much under the mark."

In a recent number of the London *Spectator* it was said: "The closing years of the nineteenth century are ushering in a change perhaps more important in its significance to our own country than any that has preceded it." This change is foreshadowed by the striking development of water-power for industrial purposes that have been witnessed both in Europe and America during the last six years. Mr. A. Mault, Engineering Inspector to the Tasmanian Board of Health, in a report on the water-power stored in the Great Lake, which is a little north of the centre of Tasmania, points out that these developments are closely connected with the use of turbines instead of water-wheels, and the conversion of the mechanical energy of the turbine into electrical energy, and its transmission to be reconverted into mechanical energy that can be used where power is required. In America the total of the larger installations is 72,000-horse power, with the prospect of increase to 150,000 when the Niagara scheme is completed. Switzerland comes next with 32,000, to be increased to 48,000 by further works on the Rhine; France has 18,000-horse power, to be increased to 30,000; Italy has 18,000; Norway and Sweden 20,000; while England and Scotland have only 4,000. Some further interesting information will be found in the present number of the *Record*, in the article headed "Water-power Possibilities."

A remarkable change seems to have come over the public demand for explosives during the eight years ending 31st December, 1896. The following is a comparison of imports during 1896, 1895, and 1889:—

	1889. Lb.	1895. Lb.	1896. Lb.
Dynamite ..	276,765	48,390	44,315
Gelatine dynamite	26,000	342,100	447,250
Sporting powder ..	182,918	103,724	161,707
Blasting gelatine..	31,775	59,450	49,900
Blasting powder ..	1,756,160	336,753	335,630
Mealed powder ..	39,585	28,850	74,300

Gelatine dynamite is evidently now the fashion, whereas dynamite and powder were the favourites in 1889. Mr. C. N. Hake, Chief Inspector of Explosives, in his brief but interesting report, shows that of 1,149 samples of explosives and 1,005 samples of mineral oils, essences, &c., examined, only 290 of the first-named, principally blasting gelatine and gelignite, were rejected. There are ten licenses existing for the manufacture of explosives, and fifty-five for rackarock. The magazine licenses total 264, and in all 2,336 licenses are held by vendors. Of seventeen persons charged with offences under the Explosives Act during the year, sixteen were convicted, but the gross amount of penalties was: Fines, £12 5s.; costs, £18 17s. 5d., and forfeiture equal to £9 = £40 2s. 5d. We submit that this is a ridiculously small total, especially as it includes a ship for anchoring inside the boundary with powder on board, the penalty being £2.—*Journal of Commerce* (Melbourne).

An important decision has recently been arrived at by Mr. Henry Foster, Victorian Minister for Mines, which will be highly approved by those connected with the mining industry. Realising the important bearing upon mining devolopment of scientific metallurgic knowledge, and of full information with respect to the most modern methods of ore reduction and gold extraction, he is submitting to the Cabinet a proposal for the establishment of a metallurgic branch of the Mines Department, under the charge of an expert possessing the most scientific knowledge of metallurgy, and also of the latest methods of extraction, particularly as directed to the saving of gold and the treatment of refractory ores. The expert he desires to appoint will be placed in charge of the laboratory, and act in conjunction with Mr. Stirling, the Government Geologist. Mr. Foster also proposes to utilise the metallurgist's services in training in the colony students competent to meet the requirements of the mining industry. He also thinks the Mines Department should take the lead in exhibiting new methods of treating ores and saving gold, and, as part of this policy, the department would train a number of geological and metallurgical students up to a certain stage, at which they could be sent to Europe and America to complete their experience. In ten years Mr. Foster thinks the Australian demand for competent metallurgists would be fully met by the Australian supply, and as it is estimated that gold to the value of half-a-million is annually lost in Victoria alone for want of better methods of gold-saving than are now adopted, he claims that the expenditure on the establishment of the metallurgic branch will be fully justified.—*Australian Mining Standard.*

The sales of water from the Mount Ida and Blackstone Hill Water-races, for the month of December, amounted to £160 1s. 11d., the number of men employed being 76, and the quantity of gold obtained 400 oz. The expenditure was £87 6s. 8d. for the month, leaving a credit balance of £72 15s. 3d. The manager of the water-races, Mr. R. Murray, reports that the month was very hot and dry, and that the water-supply had been falling steadily, until towards the end only six heads were landing, not enough to keep the miners going at half-time.

"Quite a small stir has taken place about Reefton over the successful treatment of tailings by Mr. and Mrs. Johannesburg McDonald," writes the West Coast correspondent of the *Otago Witness*: "This couple, who purchased the Big River Mine tailings for 8s. some time back, are said to be earning over 15s. per ton profit. The secret of the treatment is with Mrs. McDonald, who is only twenty-five years of age, and who also gets considerable credit as an engineer. The return for the first month's operations was worth £116."

A very interesting specimen of gold in sandstone is on view at the office of the Victorian Mount Morgan Company, 30, Queen-street, Melbourne. The sample was broken out by Mr. R. Clingan, the mine-manager, at a depth of about 130 ft. This supports what we have already drawn attention to with regard to the presence of gold in sandstone in this country. —*Australian Mining Standard.*

Prospectors' mining leases have been granted to James Thomson, Auckland, over Lot 52, Parish of Waiheke, abutting westward on the Awaawaroa Stream, for manganese and its associates; George William Basley, solicitor, Auckland, Section 6, Block III., Paeroa Survey District, bounded towards the north-east by the Rotorua–Galatea Road, and towards the north-west by the Waikomuku Stream, for petroleum; Alexander D. Clemett, William J. Harris, and Robert M. Houston, Mongonui; Robert M. Houston and Robert Bell, Whangaroa, for Omaunu No. 2 Block.

The Wangapeka River has been proclaimed a sludge-channel, the proclamation to take effect on the 7th April. This will give a considerable impetus to mining in that portion of the Nelson Provincial District.

There are at present something like 450 artesian bores in Queensland, giving an aggregate flow of 193,000,000, or 862,220 tons of water per diem. The artesian supply has been tapped in the Gulf country, which lies in the extreme north-west of Queensland, and thence at intervals right down to the border of New South Wales.

At the first sitting of the Collingwood Warden's Court, after the proclamation of the Aorere River, five special dredging claims were applied for and granted, subject to the approval of the Hon. the Minister of Mines.

Mr. T. Maude, solicitor, Christchurch, has returned from a visit to Mount Arthur District, Nelson, where he and other investors have taken up a mineral area on the Grecian Creek, which flows into the Takaka River, with the view of working deposits of asbestos. Samples have been sent to London and reported on favourably by Mr. Bell, who states that the value would be from £16 to £20 per ton. He forwarded a sample piece of cloth woven from the asbestos sent to him. It is the intention of the syndicate to lay down a tramway and to systematically work the asbestos, which they are satisfied, from the exploratory work done, can be largely and profitably developed.

An additional grant of £100 has been approved by the Hon. the Minister of Mines towards the cost of improvements in connection with the experimental plant at the Thames School of Mines. The additions will cost about £920, and the Council of the school will have to provide over a third of that amount.

During the month of December there was exported from the port of Greymouth 13,081 tons of coal, 851,637 superficial feet of timber, and 10,322 sleepers, equal to 239,986 superficial feet.

The progress of the gold-dredging industry in New Zealand has attracted considerable attention all over the world, and the mining journals in America, Canada, and Great Britain have had numerous articles on the subject. Lately gold-dredging has attracted some attention in New South Wales, and claims have been applied for on the Macquarie and other rivers. Mr. J. B. Jaquet, A.R.S.M., F.G.S., Geological Surveyor, Department of Mines, New South Wales, is now visiting this colony, with a view to making inquiries into the mode of dredging, size of claims, &c., and on his return to New South Wales will furnish a report on the subject.

Reports have reached this colony that Dr. Storer and Mr. Reginald Murray, of Melbourne, who recently visited the Champion Copper Mine at Nelson in company with Professor Black and Mr. McKay, Government Geologist, have reported favourably, and that Australian capitalists are prepared to embark in the undertaking.

Regulations for the use of the cyanide process have been prepared, and will shortly be gazetted.

THE GOLD-MINING INDUSTRY IN NEW ZEALAND.

THE following is an approximate return of the areas held under the Mining Act, annual rental, number of men employed and average earnings, number of registered companies, value of gold produced since registration, amount of capital actually paid up, and quantity and value of gold exported from 1857 to 31st March, 1897:—

Area of Special Claims, Licensed Holdings, &c., 31st March, 1897.	Annual Rental.	Number of Men Employed.	Average Earnings of Men Employed	Number of Registered Mining Companies 31st December, 1896.	Value of Gold produced since Registration to 31st December, 1896.	Total Amount of Capital actually paid up to 31st December, 1896.	Quantity and Value of Gold Exported from 1857 to 31st March, 1897.	
							Quantity.	Value.
Acres.	£		£		£	£	Oz.	£
133,282	53,650	14,889*	68	461	2,334,617	1,559,226	13,383,528	52,668,246

* Made up of 12,900 Europeans and 1,989 Chinese.

BATTERY AND GOLD RETURNS.

HAURAKI GOLDFIELDS.

Battery Returns for December, 1897.

Name of Company, Mine, or Battery.	Locality of Mine.	Number of Tons of Ore crushed.	Number of Pounds of Specimens crushed.	Number of Tons of Tailings treated.	Yield of Bullion.	Yield of Gold.	Value.
					Oz. dwt. gr.	Oz. dwt. gr.	£ s. d.
Royal Oak	Coromandel ..	36	1,074	..	..	1,163 15 0	2,904 10 6
Hauraki	" ..	255	298	..	..	525 0 0	..
Success	" ..	8	6	..	..	37 5 0	108 6 7
Triumph	" ..	40	20	..	..	20 6 0	..
Kapanga	" ..	21	34	..	..	153 18 0	..
Hauraki N.Z. Associated	Kennedy Bay	100	630	10	..	274 0 0	..
Mariposa	Kuaotunu ..	480	..	380	180 15 0	..	..
Kapai-Vermont ..	" ..	400	..	..	196 0 0	..	..
Great Mercury ..	" ..	270	..	..	94 0 0	..	..
Tararu Creek	Thames ..	..	..	200	312 0 0	..	74 2 0
Waiotahi	" ..	80	..	..	..	133 0 0	..
May Queen-Hauraki ..	" ..	382	162	..	..	604 0 0	..
May Queen Extended ..	" ..	176	390	..	..	373 7 0	..
New Alburnia	" ..	580	..	..	..	96 0 0	253 12 0
Claremont	" ..	..	15	..	..	14 5 0	..
School of Mines ..	" ..	..	8,170	..	..	6 5 0	..
Judd's Tailings Plant ..	" ..	..	..	400	..	84 0 0	..
Berry's	" ..	0½	..	..	..	4 0 0	..
Mahara-Royal	Tapu ..	220	..	..	..	161 14 0	495 4 1
Sheridan	" ..	8½	..	..	..	5 15 0	..
N.Z. Crown Mines ..	Karangahake ..	2,034	..	..	2,038 0 0	..	4,443 12 4
Woodstock	" ..	1,018	..	..	..	..	3,187 18 7
New Zealand Talisman	" ..	572	..	..	1,750 0 0	..	1,730 11 3
Waihi	Waihi ..	4,680	..	..	16,673 0 0	..	17,111 11 6
Waihi-Silverton Extended	"	1,150	..	..	816 0 0	..	1,555 0 0
Waitekauri	Waitekauri ..	2,415	..	..	4,513 0 0	..	4,859 13 11
Komata Reefs	Komata ..	320	..	..	200 0 0	..	..
Fraser and Sons ..	Auckland ..	6¼	..	..	221 14 0	..	442 15 6

WEST COAST AND OTAGO GOLDFIELDS.

Battery Returns for December, 1897.

Name of Company, Mine, or Battery.	Locality of Mine.	Quartz or Alluvial.	Number of Tons crushed or treated.	Yield of Amalgam.	Yield of Retorted Gold	Value.
NELSON AND WESTLAND.				Oz. dwt. gr.	Oz. dwt. gr.	£ s. d.
Keep-it-Dark	Reefton ..	Quartz ..	300	280 0 0	93 13 12	..
Keep-it-Dark	"	Leaders ..	75	155 10 0	77 4 0	..
W. Milliken and Party ..	Addison's Flat ..	Cement ..	3,500	..	130 0 0	..
OTAGO.						
Glenrock Consolidated ..	Macetown ..	Quartz ..	480	935 0 0	321 5 0	..
Glenrock Consolidated ..	"	Concentrates ..	24	..	25 0 0*	77 0 0
Achilles Goldfields ..	Bullendale ..	Quartz ..	589	552 0 0	264 0 0	970 0 0
Cromwell (tributers) ..	Bendigo ..	" ..	206	..	384 0 0	..
Morning Star	Preservation Inlet	" ..	323	1,587 0 0	499 12 0	..
Morning Star	" "	Tailings ..	..	213 0 0	58 14 0	..

* Melted gold.

SPECIAL CLAIMS AND LICENSED HOLDINGS.

LIST of SPECIAL CLAIMS and LICENSED HOLDINGS issued during NOVEMBER, 1897; also Number of FORFEITURES, SURRENDERS, and TRANSFERS during same Month.

District.	Number of Special Claims and Licensed Holdings granted.	Area.	Annual Rent. First Year.	Annual Rent. Subsequent Years.	Number of Forfeitures or Surrenders.	Number of Transfers.
		A. R. P.	£ s d.	£ s. d.		
Ahaura	..	..	..	..	..	1
Clyde, Blacks, Alexandra, and Roxburgh	1	45 3 13	11 10 0	23 0 0	2	1
Coromandel	3	154 0 0	7 15 0	15 0 0	33	..
Cromwell	1	40 0 0	10 0 0	20 0 0	2	..
Dunedin	2	67 2 30	17 0 0	34 0 0	..	..
Hokitika	1	15 0 0	3 15 0	7 10 0	..	..
Lawrence	4	201 2 18	51 0 0	102 0 0	2	1
Lyell	2	69 2 31	17 10 0	35 0 0	..	..
Naseby	..	..	..	..	1	..
Reefton	4	60 0 10	15 10 0	31 0 0	1	..
Tauranga*	1	29 0 0	..	..	..	..
Thames	..	..	..	..	48	3
Waikaia	2	196 3 0	49 5 0	98 10 0	..	2
Westport	2	197 1 4	49 10 0	99 0 0	..	..
Totals	23	1,076 3 26	232 15 0	465 0 0	89	8

* Private land.

WEST COAST MINING COMPANIES.

THE following particulars have been furnished by the Legal Managers, Messrs. T. Hubert Lee and Thomas F. Fenton (Reefton), and R. W. Shallcrass (Lyell) :—

Names of Companies.	Subscribed Capital.	Number of Shares.	Capital paid up.	Calls made.	Dividends declared.
	£		£ s. d.	£ s. d.	£ s. d.
Keep it-Dark Quartz-Mining Company (Limited) ..	20,000	20,000	16,208 6 8	6,208 6 8 (at 6s. 2½d.)	113,416 13 4 (at £5 13s. 5d.)
No. 2 South Keep-it-Dark Gold-mining Company (Limited)	12,000	24,000	11,700 0 0	11,700 0 0 (at 9s. 9d.)	8,600 0 0 (at 7s. 3d.)
Humphrey's Hydraulic Sluicing Company (Limited)	145,000	150,000	150,000 0 0	50,000 0 0 (at £1 on 50,000 cont. shares)	Nil.
Cumberland Gold mining Company (Limited)* ..	24,000	24,000	6,600 0 0	6,600 0 0 (at 5s. 6d.)	13,800 0 0 (at 11s. 6d.)
Dillon Extended Gold-mining Company (Limited) ..	20,000	40,000	2,833 6 8	2,833 6 8 (at 1s. 5d.)	Nil.
Success Gold-mining Company (Limited)* ..	12,000	24,000	700 0 0	700 0 0	Nil.
Buller Gold-dredging Company (Limited) ..	1,500	12,000	600 0 0	600 0 0 (at 1s.)	1,800 0 0 (at 3s.)
Exchange Quartz-mining Company (Limited)* ..	6,000	24,000	3,900 0 0	3,900 0 0	Nil.
Boatman's Exploration Gold-mining Company (Limited)	50,000	50,000	312 10 0	312 10 0	Nil.
Hercules Quartz-mining Company (Limited) ..	24,000	24,000	8,600 0 0	8,600 0 0 (at 7s. 2d.)	3,600 0 0 (at 3s.)
Golden Lead Mining Company (Limited) ..	12,000	24,000	9,700 0 0	9,700 0 0 (at 8s. 1d.)	Nil.
Inglewood Quartz-mining Company (Limited) ..	24,000	24,000	20,800 0 0	8,800 0 0	1,500 0 0
United Italy Quartz-mining Company (Limited) ..	24,000	24,000	16,250 0 0	4,250 0 0	1,020 0 0
Big River Gold-mining Company (Limited) ..	12,000	24,000	600 0 0	0 0 6	40,500 0 0 (at £1 13s. 9d.)
Golden Treasure Extended Gold-mining Company (Limited)	12,000	24,000	7,200 0 0	0 6 0	Nil.
Lord Edward Gold-mining Company (Limited) ..	12,000	24,000	15,650 0 0	0 3 0½	Nil.
Welcome Gold-mining Company (Limited) ..	110,000	110,000†	15,000 0 0	15,000 0 0 (at £1)	Nil.
United Alpine Quartz-mining Company (Limited) ‡	48,000	32,000	31,333 6 8	31,333 6 8 (at 19s. 7d.)	74,266 13 4 (at £2 6s. 5d.)
Lyell Creek Extended Quartz-mining Company (Limited) ‡	24,000	48,000	16,000 0 0	16,000 0 0 (at 6s. 8d.)	Nil.

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* The Success, Exchange, and Cumberland Companies are now amalgamated into one company, called the Cumberland Extended Gold-mining Company (Limited), in 48,000 shares of 20s. each. Success shareholders received 6,000, Exchange 12,000, and old Cumberland 30,000 shares in the now company.

† 10,000 unissued.

‡ The United Alpine and Lyell Creek are now amalgamated into one company of 50,000 shares of 10s. each, shareholders in the United Alpine receiving 32,000, and Lyell Creek shareholders 18,000.

OTAGO DREDGING RETURNS.

The following returns for the five weeks ending 1st January, 1898, have been furnished by Mr. John Gage, secretary of the Dunedin Stockbrokers' Association :—

Name of Company or Dredge.	Locality of Operations.	Yield of Gold.		
		Oz.	dwt.	gr.
Jutland Flat	Waipori	155	3	21
Upper Waipori	Waipori	99	12	0
Otago	Miller's Flat	86	7	0
Enterprise	Alexandra	77	0	13
Golden Terrace	Shotover	44	19	6
Golden Run	Miller's Flat	33	0	0
Golden Treasure	Miller's Flat	27	0	0
Golden Gate	Island Block	21	13	0
Ettrick	Ettrick	24	18	0
Moonlight *	Moke Creek	243	17	6

* Sluicing claim.

The Otago Dredge declared a dividend of 6d. per share; Enterprise, 1s. 6d. per share; and Jutland Flat, 1s. 6d. per share.

The formation of the Golden Terrace Gold-dredging Company, capital £5,000, in 5,000 shares of £1 each, is announced. This company has been formed to take over the dredges formerly owned by the Sew Hoy Company.

GEOLOGICAL EXPLORATION OF THE CAPE COLVILLE PENINSULA.

The Government Geologist's Report.

In the November issue of the Record appeared a notice of a paper by Mr. James Park "On the Geology and Veins of the Hauraki Goldfields." This was a paper read before the New Zealand Institute of Mining Engineers, and, besides giving a general account of the geology of the district, dealt with such subjects as the origin of the gold, its introduction into reefs and veins, indicated the different classes of country in which auriferous lodes more or less abounded, and closed with a description of the local areas constituting the different separate goldfields of the Peninsula.

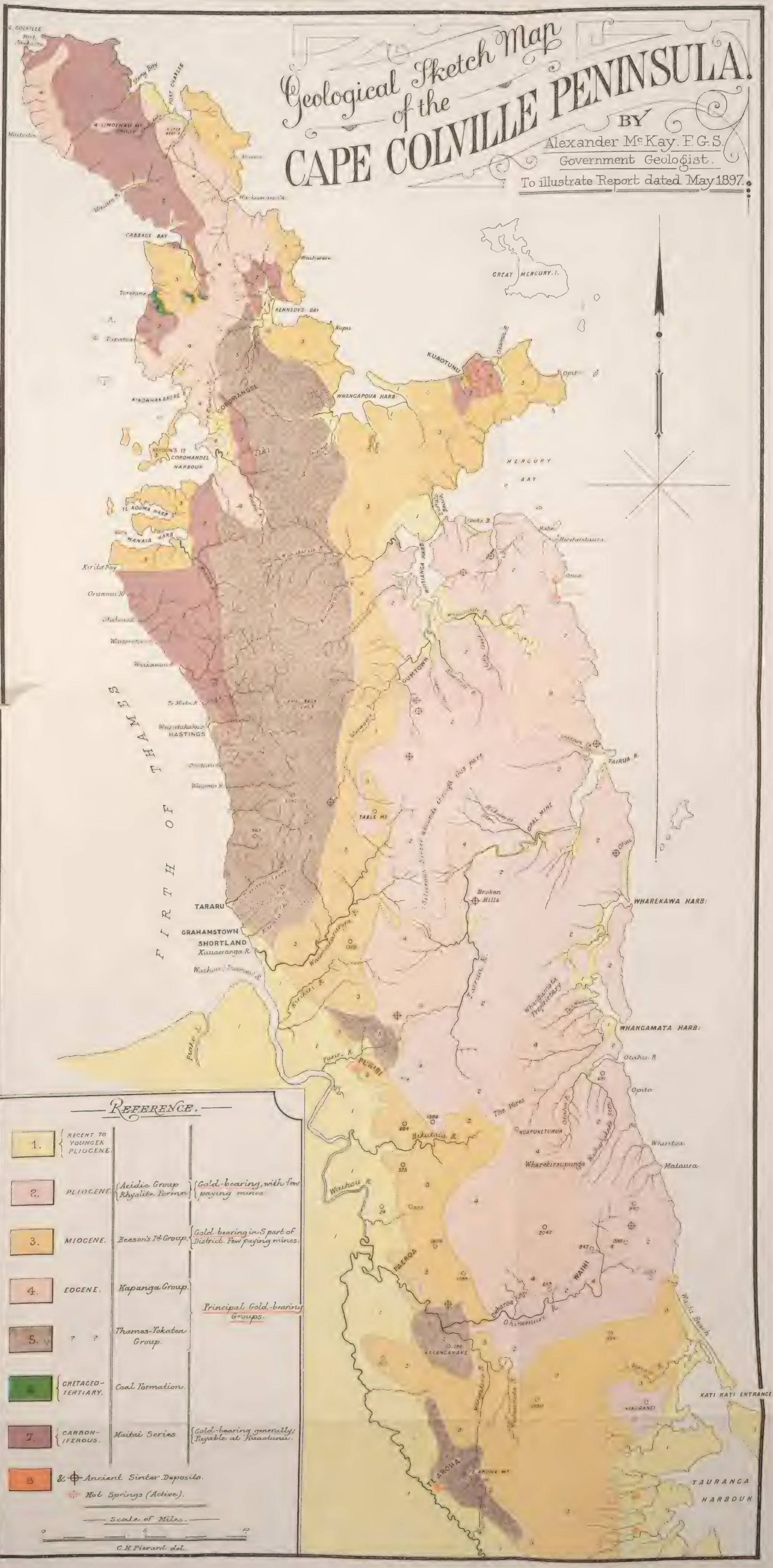
The paper now referred to is a departmental report, presented to both Houses of the General Assembly, illustrated by a carefully-compiled and beautifully-executed map of the geology of the whole of the Peninsula, from Cape Jackson, in the north, to a line drawn from the west shore of Tauranga Harbour to the Waitohi Plain, south of Te Aroha, where the Peninsula may be said to terminate. Mr. McKay's labours of the past year are to be continued during the present season; and, as in the past, geological examinations had been limited to areas contained within or immediately surrounding the gold-mining centres of Coromandel, Thames, Kuaotunu, Puriri, the Ohinemuri Valley, and at Te Aroha, the greater part of the Peninsula was thus geologically unexplored.

The revival of mining which has taken place within the past three years has led the prospector into almost all parts of the Peninsula, resulting in the discovery of gold at places to which previous geological surveys had not extended; and hence, as a preliminary to a complete knowledge of the circumstances under which the gold occurred in different parts, it was necessary that something like an approximately correct knowledge of the geology of the whole district should be obtained. Owing to the rugged nature of the greater part of the country, and the frequently indefinite character of the rocks to be examined, the undertaking proved a work of great labour and no little difficulty, and in but little aided by past research. A complete scheme of classification for the rocks of the Peninsula had to be worked out, which, differing from all hitherto produced, appears in its proper place in the report. The nature and relations of the different rocks being ascertained, the next important work was to approximately determine the limits of the different formations and groups of rocks, and how well or otherwise this has been done must be left to the judgment of experts in such matters who may examine parts or the whole of the Peninsula, map in hand. The very full descriptions in the letterpress of the report go far to establish the accuracy of the map, and the same abounds in descriptions which, from the nature of them, cannot be illustrated on the plain surface of a geological map.

As introductory to the more essentially geological part of the report, a section is devoted to a description of the physical geography of the Peninsula. The following extracts, together with the map, will tend to give some idea of the general scope of the report, which occupies seventy-four pages of closely-printed foolscap :—

PHYSICAL GEOGRAPHY.

Peninsular Auckland, or that part of the provincial district which lies to the northward of a line drawn from Kawhia, on the western coast, to Tauranga on the Bay of Plenty, has extension in a north-west and south-east direction, and gives evidence—contrary to what now is—of a former linear extension of New Zealand along such line far beyond the limits of the present land. This obtained during early Cretaceous times, and long prior to the appearance of the Southern Alps, or of the mountains of the main chain extending from Cook Strait to the Bay of Plenty in the North Island.



Geological Sketch Map of the
CAPE COLVILLE PENINSULA.

BY

Alexander McKay. F.G.S.

Government Geologist.

To illustrate Report dated May 1897.

From the east side of the south part of peninsular Auckland springs the Cape Colville Peninsula. This is bounded on the east side by the ocean, and on the west side by the Hauraki Gulf and the Frith of Thames. Strictly speaking, the Peninsula may be considered as terminated along a line drawn between the mouths of the Thames and Tairua Rivers. Doubtless this is true, but it must be apparent to every one having knowledge of the district that the tract of broad low swampy plain across which the Thames and Piako Rivers find their way to the sea is of extremely modern date. This extensive plain is for many miles to the south but a few feet above the level of the sea, and is unquestionably due to the action of the Waikato River filling in and reclaiming the southern portion of the Hauraki Gulf.

There is thus reason to believe that once, and (geologically speaking) at no distant date, the southern continuation of the mountains of the Cape Colville Range were peninsular to and beyond Mount Te Aroha, or, in other words, to where the range ceases and the high sloping plateau to the south and south-east begins. Hence the whole region may properly be treated of as included in and forming the Cape Colville Peninsula.

The surface of the Peninsula is generally broken, in some parts extremely rugged, and along the main axis the mountains rise to an elevation of 2,000 ft. to 3,000 ft. The culminating points are in the extreme north and south parts, Moehau and Te Aroha being mountains of about equal height. Te Aroha does not stand on the main axis or water-divide, but somewhat to the westward, and is built up of rocks belonging to the first and second periods of volcanic activity, as displayed on Cape Colville Peninsula. Moehau, on the other hand, of nearly equal height, terminates towards the north of the main range, and is itself a mountain formed of Palæozoic or older Mesozoic strata; hence for it may be claimed the chief place among the mountains of the Peninsula.

* * * * *

North of Cabbage Bay the bulk of the country is formed of slate and sandstone of Carboniferous age, but on the east slopes of Moehau, and between the foot of the main peak and the sea, there is a considerable development of volcanic rock. Slate rocks, however, appear in the valleys on this side of the mountain down to 140 ft. above sea-level. Abreast of Cabbage Bay the slates are confined to the western slope of the range, but more to the south they appear on both the east and west flanks of the range, the volcanic rocks merely capping them and forming the higher part of the range. Slates appear as a small outcrop at the head of Cabbage Bay, on its south side, and on the coast-line from Torihine to Paparoa, but are not again seen on the shore-line till reaching the south side of Coromandel Harbour.

The presence of slate under the volcanic rocks of the Tokatea Range has been proved in various mine-workings, which show that the slates rise to a height of 1,020 ft. above sea-level. On the western middle slope of the Success Range the slates are exposed at the surface, and on this side of the main water-divide they continue to the southward to abreast of the middle part of the Castle Rock Range, where in connection with the main range for a time they terminate. A little to the north of this termination slates appear further to the west, on the shore of Coromandel Harbour, and this area of slate for a time, flanked to the west by volcanic rocks, in its south extension, reaches the shore of the gulf at Kirita Inlet, south of Manaia Harbour. There is between the shore of the gulf at this point and the eastern limit of the slate a breadth of four miles, which, next to the Moehau area, is the greatest width of slates on the Peninsula. Gradually the width of the slate belt lessens in a south direction to its termination in the gorge of Tapu Creek. Further south, at Waiohanga or Rocky Point, near the Thames, there is a small exposure of slate beyond which no slate is known in the southern part of the Peninsula. Slates appear isolated and away from the main range in the Kuaotunu Peninsula.

These rocks are thus mainly confined to the western slope of the main range north of the Thames, and to both slopes of Moehau in the northern part of the Peninsula. Near Cabbage Bay there is a development of the coal-bearing series of Cretaceous or old Tertiary date, but this, though once a widespread formation, has for the most part been denuded away, and is now of but little consequence as affecting the physical features of the district, being to a large extent covered up by younger volcanic rocks.

Volcanic rocks of different ages overlie the slates, and each division, with the exception of the youngest, the acidic rocks or rhyolite formation, are at one or other place found resting on the slate formation. The general arrangement, however, is as a succession of strata and groups of volcanic rocks that strike in a north-east direction, and dip to the south-east, and this is true of the whole of the Peninsula, though local deviations from the rule are not infrequent.

After all the important formations of the Peninsula had been deposited, movements still were continued, the commencement of which was of the date of the Kapanga group, whereby the rocks to the west and north were elevated and those to the south and east were depressed. And thus as time went on and denudation proceeded, the slates—the oldest rocks—appeared along the west coast, and in the northern part, and in accordance with and as a result of the same causes the rhyolite formation has its greatest development in the south and east, and is altogether absent from the northern part of the Peninsula.

* * * * *

Movements whereby the western side of the Peninsula has been raised and the eastern lowered have been in operation for a considerable time, and are still going on. The evidences of elevation within quite modern times are seen at the Thames, and on the coast-line north of Tapu Creek as far as the Orunui Stream, sea-beach gravels in this part being found at levels 200 ft. above the sea. North of this, direct evidence, as exemplified by the presence of old sea-beaches on the coast-line, is not abundant, nor very apparent; but at Torihine, three miles south of Cabbage Bay, old beach shingle reach to a height of 80 ft. above the present tide-mark. All the streams on the west side are tidal but for a short distance from where they enter the gulf, or the different harbours along its eastern shore, and none of them are tidal at low water. The deeper-seated rocks of the Peninsula appear also on this to a greater extent than on the eastern side of the Peninsula. On Moehau they rise to 2,500 ft.; at Cabbage Bay, on the Tokatea and Success Ranges, and thence to the Tiki, the height to which the slates attain on the west side of the range is from 800 ft. to 1,000 ft. Further south they reach to lesser heights, till they disappear beneath the volcanic rocks of Tapu Creek, at a moderate height above sea-level. In Rocky Point, near the Thames, they are last seen on the west side of the principal water-divide, and as an isolated outcrop reach to from 200 ft. to 300 ft. above the level of the sea.

DESCRIPTION OF THE DIFFERENT FORMATIONS OCCURRING ON THE CAPE COLVILLE PENINSULA.

The scheme of classification includes divisions of the volcanic series not hitherto recognised by other writers on the geology of the Peninsula, and may in some cases be considered unnecessary; but I am fully convinced that in the field the distinctions made can in most cases be readily followed; besides which in every case there is a chronological reason for the separation of the different groups, this being the unconformable relations that subsist between them. It is not denied but that some modifications of the mapping of the different boundaries may be necessary; this is to be expected, but on the whole the sequence of the different groups, and, approximately, the areas assigned to them, will be found fairly correct. Despite the difficulties in the way of this first attempt to describe the geology of the whole of the Peninsula, it is hoped that a body of facts has been brought together such as will serve the purpose for which the work was undertaken, and afford valuable insight to the structure of the Peninsula as a whole, and also be of value as regards particular localities.

Table of Formations.

Probable Age.	Name of Formation or Group.	Characteristic Rocks,
8. Carboniferous ..	Maitai series ..	Slaty breccias, grits, sandstones, siliceous and argillaceous mudstones, often calcareous, carbonised plants, and thin seams of impure coal.
7. Cretaceo-tertiary	Coal formation	Conglomerates, sands, clays, and limestones with coal.
6. ?	Thames-Tokatea group	Volcanic ejectamenta, mainly andesic, solid fragmental or tufaceous, with traces of coal.
5. Older Tertiary ..	Kapanga group	Volcanic ejectamenta, mainly andesic, solid fragmental or tufaceous, with traces of coal.
4. Miocene ..	Beeson's Island group	Volcanic ejectamenta, mainly andesic, in places trachytic, solid fragmental or tufaceous, with sedimentary deposits and seams of coal.
3. Older Pliocene..	Acidic group ..	Volcanic ejectamenta; trachytes, rhyolites, porlite, spherulite, obsidian, &c., solid or tufaceous, with sedimentary beds and traces of coal.
2. Newer Pliocene or Pleistocene	Kauaeranga beds	Grey sandy beds and ferruginous clays.
1. Recent ..	Recent deposits	Various kinds of deposit, from coarse beach or river shingle to pumice sand and clays.

Dyke intrusions and thermal-spring deposits.

LOWER CARBONIFEROUS.

Maitai Series.—These are the oldest rocks found or likely to be found on the Cape Colville Peninsula. Of them, Hochstetter says they form the nucleus of the mountain-ranges of the Peninsula, and other succeeding writers have expressed the opinion that these rocks are to be or may be found from Cape Colville as far south as the Puriri River or Waihi Beach. During the investigations conducted for the purposes of this report the last traces of this formation were met with along a line drawn from the northern headland of Mercury Bay to Rocky Point near the Thames.

The chief developments of this series are in the northern part, and along the western side of the Peninsula to the points stated. In the northern part, the slates and associated rocks form the headland of Cape Colville and the opposing headland on the west side of Port Jackson. They also rise into and form the mass of Moehau, the highest mountain in the northern part of the Peninsula. Thence they extend south along the west side to Cabbage Bay, and along the coast-line to the south of Cabbage Bay, as far as Paparoa; are seen at Kennedy Bay, in the Tokatea Range, and at Kuaotunu. Between the Tokatea Saddle and Castle Rock they form the lower western flanks of the main range. South of Coromandel Harbour they are largely developed a little inland of the coast, or on the coast-line, as far as Tapu Creek, and finally are seen at Rocky Point, a little north of Tararu Creek at the Thames.

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At Kuaotunu these rocks are well exposed on the beach and along the north shore-line of the Peninsula, from fully a mile west of the township to the eastern end of the high cliffs that terminate the northern slopes and out-running spurs of Black Jack on the Waitaia Range. Black Jack is a rugged peak rising immediately at the back of Kuaotunu Township, and is formed of rocks belonging to the Maitai series, saturated with siliceous deposits, the result of thermal action. This constitutes the northern peak of the Waitaia Range, which runs north-north-west and south-south-east across the Peninsula, near its eastern or landward end. Essentially, this range is composed of slates and sandstones belonging to the Maitai series, but towards its southern end volcanic ejectamenta cover up the sedimentary rocks; these, and these only, are seen at the surface from the trig. station to the shores at Mercury Bay. The eastern boundary of the slates runs from the shore of Kuaotunu Bay south-east to near Brown's camp, on the road from Kuaotunu to Mercury Bay, and thus the area of slates and sandstones is approximately about three miles in length east and west, and somewhat better than two miles broad in a north and south direction. The rocks on the coast-line consist of hard grey sandstones, often with small angular inclusions of slate and bands of sandstone or shale interbedded. At some places, the strike is nearly east and west, but as a rule it is in a northerly direction, and the dip is variable, but mostly to the eastward. On the shore-line, though towards the east the rocks in the sea-cliffs are much decomposed, there is no difficulty in recognising these rocks, nor should there be in any part of the area covered by them. Yet where decomposed at the surface they have been mistaken for and described as volcanic rocks.

South of the middle part of the Waitaia Range a line of auriferous quartz occurs in the Waitaia Mine, trending north-north-east, and others are present in a spur of slate and sandstone country that lies between the two main branches of Kuaotunu Creek. On the principal line of reef are situated the more important mines of the Kuaotunu district and goldfield. The field was examined in 1893 by Mr. James Park, late Director of the Thames School of Mines. Mr. Park describes the rocks forming the spur between the two branches of the Kuaotunu as being of volcanic origin; but deeper mining and road-cuttings, &c., have shown the true nature of the rock. These slates are surrounded on the east, south, and west by volcanic rocks, and rise to a height of 600 ft., and are generally arranged as a syncline. They show the presence of the middle and lower parts of the series as developed in the Cape Colville Peninsula.

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On the west side of the Peninsula gold-mining in the slate country, it has to be confessed, has not been successfully carried on. And now mining-men are beginning to regard the slate as a kind of Farewell rock, and to avoid it accordingly. Theoretically there is no reason why it should be so regarded, and practically in the experience of the past, and over other mining districts even within New Zealand, the slates of the Carboniferous period prove their capacity to carry numerous and rich reefs of auriferous quartz. In this respect the rocks of the same age seem to fail on the west side of the Cape Colville Peninsula; but it would be wrong to arrive at a hasty and premature conclusion in that respect, since in but few instances have the slates been proved to any great depth from the surface or their contact with the overlying volcanic rock.

Opinion has been and still is to some extent divided on the question of deep mining in the slate country, and various different theories as to the whence of the gold in the reefs of the Thames-Tokatea and Kapanga groups are responsible for this. Those who maintain that the gold is by thermal agencies derived from deep-seated rocks, and with its associated silica now forms ore bodies traversing formations diverse in character, as are the slates and superimposed volcanic rocks, find no difficulty in postulating the existence of rich metallic and auriferous deposits in the slate country. On the other hand, there are those who maintain that the gold from its primary source has been brought to the surface or near to the surface by being included in and as forming part of the volcanic ejectamenta that covers and forms so large a part of the Cape Colville Peninsula. These theorists cite in support of their views the usual presence of small quantities of gold and silver in the volcanic rocks themselves; the numerous strings and small leaders of quartz, often auriferous, that from the superior rocks feed into and supply as it were the main lode itself; the fact also that special volcanic rocks are the principal repositories of the gold; and, finally, that the gold-bearing veins in the slates are almost exclusively but the continuation downwards of auriferous lodes that are present in the overlying volcanic rocks, or have been, where these and the upper part of the lodes have been removed by denudation. As is usual in such cases there may be truth on both sides, and amid a conflict of evidence it were unwise to attempt a solution of the problem before the whole of the facts have been placed in review.

One important locality in connection with mining in the slates has yet to be considered. This is the slate area forming part of the Kuaotunu Peninsula. Within this, the evident influences that have been the main agent in the deposit of the principal quartz reefs are thermal waters, the source of which, though not distant from the scene of volcanic action, is not directly from volcanic rocks. There can be no doubt whatever that the vast accumulations of siliceous sinter that form such a prominent feature on the higher part and eastern slope of the Waitaia Range have been derived from the slate country that underlies and forms the bulk of that range, or from unknown rocks of a more siliceous type underlying these. Neither need it be doubted that the principal reefs of the Kuaotunu field have been deposited by thermal agencies bringing their burden of silica and more valuable products from below, and not from any volcanic rocks at or near the surface. In view of these considerations it may therefore be prudent to defer judgment on a matter on which so much may be advanced on both sides, and simply acknowledge in this place the fact that gold-mining in the slates has not hitherto, on the west side of the Peninsula, been a successful venture; while, on the other hand, the bulk of the gold obtained from the Kuaotunu field has been taken from reefs in slate country, the material and contents of which could not have been supplied from adjacent or overlying volcanic rocks.

Volcanic Formations.

The great feature of the Cape Colville Peninsula at the present time is a vast accumulation of volcanic matter, that, from the northern extremity to where the land ceases to be peninsular, gives to the entire district its peculiar character. This is piled up in mountain masses, and gives to the greater part of the Peninsula the rugged character that distinguishes it. The physical features of the present day are, however, the result of sub-aërial denudation after the last of the four great groups of volcanic rocks had been errupted. There were periods of denudation and of sedimentary deposit between each of the great divisions of volcanic rocks; and before the commencement of each succeeding display of volcanic energy the surface of the older deposits had been greatly modified. Unconformities are therefore to be traced, some of which are well marked locally. In other cases decisive evidence is not to be obtained, but the general arrangement of the rocks, if considered carefully in detail, points to the fact that the older group had to a large extent been denuded before the commencement of the succeeding outburst. Previous writers on the geology of the Cape Colville Peninsula have generally considered that the volcanic rocks of the district belonged to two, and in some cases three, distinct periods of time. As, for instance, the rocks of the Thames and Coromandel Goldfields, and the younger series known as the trachytic breccias of Beeson's Island. The rhyolitic rocks of south-eastern part of the district are mentioned both by Hector and Cox, and latterly by Park, but no one clearly defines the position of these in relation to the other rocks of the Cape Colville Peninsula. Sometimes these latter are regarded as the equivalents and an extension northward of the trachytic and rhyolitic rocks of Rotorua and the interior central parts of the North Island, but no one has investigated their relations to the rocks of the Beeson's Island group.

Thames-Tokatea Group.

The rocks of this group are in the main fine-grained tufas, ash, or breccia beds consolidated to form the "sandstone" of the gold-miner. At many places there are interstratified floes and intrusive dykes of crystalline volcanic rocks, decomposed, or but little altered. The colours of the fragmental rocks vary from whitish through light-grey to dark- or greenish-grey, and not unfrequently in surface exposures are of a brownish tint. When solid and crystalline the rocks are of various shades of grey to almost black, according as the different minerals felspar, hornblende, or augite prevail or predominate. Numerous samples of these rocks were collected from the Coromandel district illustrative of their characteristics, but these have yet to be critically examined. And, for reasons given in the report dealing with the silver-bearing lodes of the Great Barrier Island, they shall be here spoken of as light- and dark-grey andesites, with accompanying breccia ash and tufa beds of the same character; and this will apply to the rocks not only of the Thames-Tokatea group, but to those of the Kapanga and Beeson's Island groups as well.

THE KAPANGA GROUP.

This has typical developments in three different districts of the Peninsula: First, in the northern part, in which it is present from Stony Bay, near Cape Colville, on both sides of the Peninsula, to a little south of Cabbage Bay, and thence along the west side through the Kapanga and Coromandel districts to the water-parting between the Waiau and Manaia Rivers. Second, from Table Mountain it forms the deeper-seated rocks along the mountain-range that forms the water-divide between the east and west drainage-areas of that part as far to the south as the sources of the left-hand branch of the Puriri. This area includes Broken Hills on the east side of the Lower Tairua. Third, the extensive and important area of auriferous country that from the northern inner part of the Whangamata Harbour extends south and south-west to Waihi and Waitekauri. The area of andesic rocks on the east coast, between Boat Harbour and the neck of sandhills between the estuary of the Tairua and the sea, though separate and apart from it, may be regarded as part of the second area into which, for purposes of description, the group is here divided.

The northern area, which includes the typical name-giving locality, exhibits a series of rocks that consist mainly of volcanic ejectamenta that in greater part consist of fine or coarser breccias associated with ash and tufa beds that give evidence of having, within limited areas, been laid down under water, in marshes, lagoons, or lakes of limited extent; and sometimes, but very rarely, conglomerates, consisting of volcanic material, have been formed.

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The Kapanga Group considered in relation to the Thames-Tokatea Group of the Volcanic Series.—Hitherto these rocks have been considered identical, and by other writers whenever unconformity between different parts of the volcanic series has been referred to, it is evident that it was the rocks of the Beeson's Island group that formed the overlying unconformable division. Though the lower and older divisions have been described as highly indurated in comparison with rocks at higher levels or higher in the series, in most previous reports the idea conveyed is that the whole belongs to one period of volcanic activity and deposit.

The rocks forming the two groups, it must be admitted, are typically the same in character, but it is easy to observe that generally the Thames-Tokatea rocks have been subject to greater change, removal, and alteration of their constituent minerals, and, as a rule, in spite of decomposition at and near the surface, that they have been solid and compacted to a degree far greater than characterizes the general bulk of the Kapanga rocks. Along lines of strong mineralisation the spoil from the mines may in cases be very similar, but this does not affect the rocks as a whole.

Whatever may be the value of the evidence which the condition of the rocks affords, the manner of their distribution and arrangement of the rocks in section gives evidence that is sufficiently decisive. Within the Thames-Coromandel area the thickness of the Thames-Tokatea group is very considerable, ranging from 1,000 ft. to 2,000 ft., and at places even more. In the section from where the slates disappear on the road to the Success Mine, across the Success Range to the Four-in-Hand Mine, the greater thickness mentioned must be exceeded, as it must be from the source of the Manaia to Hooker's Store, on the road to Mercury Bay, and farther south in the section from the shore of Hauraki Gulf to the source of Waiwawa Creek, a little west of Table Mountain. The nature of the material is such that it is largely the result of paroxysmal explosions from probably a number of volcanic vents—whether submarine or terrestrial, as far as the present concern, is of little consequence. It is certain that it could not have been piled up along the higher part of a mountain-range, as it appears in the Coromandel district from the Tokatea to the southern boundary of the county, leaving the slates to the westward uncovered and bare for the reception of deposits of the Kapanga period. These latter rest on the slates laid bare towards the west, reach on to the range, and overlap the rocks of the Thames-Tokatea group north of the Triumph Mine; and in the same vicinity show that, if the older series are of marine origin, land must have appeared and vegetation sprung up in the interval between the first and second periods of eruption. Considerable denudation is further proved by the rolled and water-worn volcanic material at the base of the Kapanga group, on the west side of the Waiau Valley, opposite Castle Rock. Consequently, the contrasting condition of the rocks, the evidence of a land-surface, and, much more, the proofs of the great and long-continued denudation of the Thames-Tokatea rocks prior to the deposit of those of the Kapanga group, are proofs of their distinctness, and warranty for the distinction which has been made.

UPPER MIOCENE.

Beeson's Island Group.—These rocks were first described by Hochstetter as "trachytic breccia and tuff," forming the islands and coast-line in the vicinity of Coromandel Harbour. Regardless of whether they should be called trachytes or andesites, the same rocks, besides forming Beeson's Island, some of the other outlying islands, and the peninsula on the north side of the harbour, are present on the south side of the harbour, and form between Coromandel and Manaia Harbours west of the Coromandel–Thames Road, the country to the sea. South of the Manaia Harbour the same rocks form the country south and west of Manaia Harbour and the alluvial flat along the lower course of the Manaia River to Kirita Bay, where along an east and west line they are suddenly terminated. This is the typical and most characteristic locality of these rocks.

Sometimes, as may be gathered from the extracts made from former writers on the geology of the district, the coast to the north of Coromandel Harbour is considered as being formed of trachytic tufa the same as met with in Beeson's Island, and even the mainland north of the lower part of Kapanga Creek has been described as such, and this apart from the fact that the two older groups—the Thames-Tokatea and Kapanga groups—are often described as being formed of rocks of a trachytic character.

These rocks from Beeson's Island to Kirita Bay are generally coarse breccias of a light-grey colour, but rocks, dark as normal augite andesite, are met with at many places. Thick beds or elliptic masses of clayey tufa of various colours — blue, purple, red, or white — are of frequent occurrence, alternating with the coarser breccias. Sometimes beds of intermediate grade form tufaceous sandstones that show bedding planes and stratification with some degree of regularity for considerable distances, as, for instance, in the peninsula between Coromandel and Manaia Harbours. At other places soils have been formed in the intervals between periods of activity of the volcanic vents, and in or on these quantities of fossilised wood are to be found.

OLDER PLIOCENE.

Acidic Group. — Within the mountainous and hilly parts of the peninsula these rocks are for the most part confined to the eastern watershed and the district south of Mercury Bay. With respect to the pumiceous deposits of the plain west of the mountains and south of the Thames, these, consisting mainly of sands and gravel of recent date, have to be treated elsewhere in this report.

The group as developed in the mountains and on the east side of the Peninsula consists of a variety of rocks, some of which are, chemically, doubtfully to be considered under this head, but which are stratigraphically or otherwise connected with it. Near the southern source of the Waiwawa River there is a development of soft sandstones and shales with coal seams, followed by a conglomerate mainly consisting of andesic rocks that interpose between the rocks of Beeson's Island group and the rhyolite formation of that part, but these are associated with rhyolitic tuffs following them without apparent break in the sequence, and are unconformable to the rocks upon which they rest, and, consequently, have either to be treated of apart from the former or as part of this group, and, as other similar deposits occur in higher horizons, and in other localities, they cannot well be dealt with other than as here proposed. Sometimes, also, deposits that are mainly rhyolitic, as in the cliffs along the south shore of Mercury Bay and the east side of Whitianga Harbour, contain a proportion of andesic rocks as inclusions, and also in the same vicinity there are limited areas of devitrified rocks of an andesic type: these have not to be considered as affecting generally the character of the rocks within that region. Also, in the district round the sources of the Rangihua, frequent masses of andesite are met with, the source of which cannot be clearly stated, but, as the bulk of the country is decidedly formed of rhyolite, they, in a general description such as this is, may, apart from the mention of them, be disregarded. The like also occurs in some parts of the valley of Stony Creek, and on the higher parts of the main range; and again on the western slope of this there are massive outcrops of andesic rocks in a district of which the great bulk of the rocks undoubtedly belong to the Acidic group. Andesites are also reported as occurring in the mountains on the north side of the entrance to the Tairua River, but whether this be so or no the great bulk of the mountain is formed of spherulitic rhyolite. In the Ohinemuri Valley, near Owharoa, rocks of a highly felspathic character occur in association with rhyolites, and these it might be claimed do not belong to the group, but none the less they occur in association with and gradually pass into the adjacent rhyolites. Sedimentary beds mainly but not wholly of rhyolitic material occur at many places within the area mapped as covered by rocks belonging to this group, yet these, however denominated, cannot be conveniently dealt with separate and apart from the bulk of the great Acidic group of rocks now to be described.

Fragmental or solid, the bulk of the formation consists of rhyolite, which may be completely devitrified, as round the head-waters of the Hikutaia River, spherulitic or perlitic, but generally as a more or less devitrified rock exhibiting in a marked degree fluxion-structure, and may be massive, porous, or brecciated.

GOLD.

It is doubtful whether the flinty-hornstone reefs found in the slates of Cabbage Bay and the northern part of the Peninsula are gold-bearing. They probably originated prior to the commencement of the volcanic activity that deposited the Thames-Tokatea and younger groups of volcanic rock, and therefore they may be left out of consideration.

Two main lines or belts of auriferous country are traceable, the first along the west side of the Peninsula from Puriri to Cabbage Bay, to which also the gold of Karangahake and Te Aroha may be referred; the second lies along the east side of the Peninsula from Kuaotunu Peninsula to Waihi and Waitekauri. Of the first, this is chiefly confined to the rocks of the Thames-Tokatea and Kapanga groups, but also at several places is found in slate country.

Whether there may have been two periods of gold-impregnation is a question which may not admit of determination at the present time; and whether on the one side of the Peninsula the quartz has been deposited by other than thermal agencies of an intense degree, and on the other in the presence of such intense thermal agency, may be also left for future decision. Apparently, however, the reefs in the older groups of volcanic rocks along the west side of the Peninsula are of much deeper-seated origin than those on the east side, and this may be a reason sufficient to account for the difference that obtains between the quartz on the two sides of the Peninsula. While chalcedonic, ribboned, and jasperoid quartz is not absent from the western slope of the Peninsula, massive sparry and crystallized quartz are the characteristic forms on this side. Calcite, perhaps as a secondary introduction into the reefs, is also much more common on the west than on the east side. The gold itself differs, not so much in mineral composition as an alloy of gold and silver as in the manner in which it is aggregated in the substance of the reefs or in connection therewith. On the west side it occurs visible and massive as very rich "pockets," or distributed as "blobs" and "dabs" throughout the stone or towards the walls of the reef or leader; often also entangled between the points of the crystals in drusy cavities—conditions that are not often exemplified on the east side of the Peninsula. All this may have arisen from the fact that we have now to deal with a formation the higher part of which is either non-auriferous or has been removed by denudation, a truth which seems to be demonstrated by the fact that the productive areas on the west side of the Peninsula, from the Thames to Cabbage Bay, are never far removed from the underlying slates. This has resulted obviously from the gold finding a resting-place near or being deposited in the lower part of the formation, whether of the Kapanga or the Thames-Tokatea group, and now being exposed or brought within reach of the miner by the tilting of the north end and west side of the Peninsula, and the denudation that followed, by means of which, as a necessary consequence, the slates and deeper-seated volcanic rocks were exposed.

As regards the continuance of the gold-bearing reefs into the slate formation that underlies the volcanic series, there are many well-established instances of this, and yet mining in slate on the west side of the Peninsula has not been established on a sound basis.

On the east side of the Peninsula the gold is fine, and for the most part evenly distributed through the reefs Pockets of gold and specimen stone are not common, and—perhaps due to the more superficial character of the workings—refractory minerals are less common, and the ore is in comparison eminently fit for the application of the cyanide process as a means of gold extraction. On the whole, therefore, it would appear that in the one case we are dealing with the roots, in the other case with the branches, of the tree, and in the latter case it must be left to inference where the bole and trunk of the tree is to be sought for.

Concluding Remarks.

The foregoing report embodies the results of the past year's work within the boundaries of the Cape Colville Peninsula. Necessarily, over so extensive an area, difficult of exploration, and of which the geology was not only difficult but practically over the greater part unknown, not much of close and detailed geology was to be expected. Nor under the circumstances was this attempted. In such a case the collection of rock-specimens necessary to illustrate the rocks of different formations and special localities would have proved such an impediment that but a small part of the whole could have been examined during the past season. The collecting of evidence from mines had also in a great measure to be abandoned, other than so far as this was necessary to a knowledge of the formation within which these might chance to lie.

The broader questions relating to the age, character, and limits of the older sedimentary formations and the volcanic rocks of the Peninsula, the relations of these to each other, and the modification of the surface due to the greater movements of the Peninsula, &c., though seemingly not directly connected with an investigation of which mining and the advancement of mining was the principal object, yet proved of such essential consequence that without this knowledge the main object could not be effected.

EDISON'S IRON-ORE WORKING PROCESS.*

IF half what is claimed for the enterprise proves true, Edison will save the Atlantic slope from the tremendous losses that would follow the migration of the iron industry to the great iron and steel centres west of the Alleghanies. That migration began years ago and had progressed to the point of closing many eastern plants before Edison discovered the enormous deposits of low-grade iron-ore in New Jersey and set about devising a cheap process of separating the metal from its bed of useless rock. Now the iron and steel industries of the East feel that they have been saved from annihilation. They may not be able to compete with the Lake Superior ores, which are torn from the ground with steam-shovels and loaded directly upon the railroad cars, but it may be possible to keep the western products from taking the home market away from the old mills along the Atlantic seaboard.

The system is simple. The iron-bearing rocks are ground to fine sand in immense crushers. The sand is dropped in a stream near a magnet. The iron is deflected far enough to fall in a special receptacle, while the sand drops down and lands in the waste heap. The fine particles of iron are compressed and baked into briquettes and poured in a rattling stream into flat cars which carry them to the iron-mills. Seventy-five car-loads of pure iron are torn out of the rocks daily by Mr. Edison's great plant in the wilderness of New Jersey. It competes successfully with the iron from mines where these processes of separation are not required. And there is enough of it in the 16,000 acres of land around the Town of Edison to supply the whole United States for seventy years. It is predicted that in a short time these immense beds of ore lying near the Atlantic will not only supply the iron used in the Eastern States, but will be sent abroad to keep the industries of Great Britain from stagnation. The possibilities of the work are so vast that it is not surprising that the inventor has left for a time his work of doing startling things with electrical novelties to work out this industrial revolution. It may be that his name will be remembered longer in connection with the iron industry than in the field in which he had before gained so much fame.

In reading the descriptions sent to the *Mining and Scientific Press* the first thought is that the stated amount of work must necessarily tear any machinery to pieces. Edison says he has gone into the matter of repairs and renewals thoroughly, and calculates that $14,000 per annum is a liberal allowance therefor.

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Sixteen years ago Edison was walking along the seashore on Long Island when he noticed a pile of black sand piled up on the beach. With the zeal of the scientific investigator he carried some of it home to his laboratory, procured an electro-magnet, held it near the mass, and immediately little dark grains separated themselves from the heap and scurried across like so many black ants to the spot over which the magnet was held. The little ants were really grains of iron-ore. This sand covered the shore in spots for fifteen miles along the coast, just as the black sand is found in bunches all along the California coast from the Oregon line down to a point south of San Francisco. Unlike the California beach sand, there was no gold in it. This Atlantic coast black sand was due to the erosion of Connecticut rocks by water—for magnetite is one of the constituents of the primal rocks found in Connecticut. Edison calculated that the deposits must contain millions of tons of iron which, if it could be smelted, would become a valuable product. On the basis of his find he evolved his famous magnetic-ore separating-machine, which he exhibited at the last Paris Exposition. Then he let out the privilege of using it to a contractor, who set up a plant on the beach and proceeded to separate the iron-ore from the sand, with every prospect of devoloping an extensive industry. But the sea proved to be less generous than it had at first promised to be, for one dark night there came a storm such as had not visited the place for many years, and when the contractor came to visit his plant the next morning not a vestige of the black sand remained. It had all been swept into the sea from whence it came, a parallel case to that of the beach-sand gold-mines at Port Orford, Curry County, Or., and on the Humboldt County, Cal., coast. When the condition of affairs in the iron trade was brought to Mr. Edison's attention, eight years ago, he thought of the ill-fated Long Island enterprise, and of his discarded magnetic separator, and wondered if it might not in the end present a true solution of the difficulty. In order to assure himself of the exact condition of the iron-mines in the East, he made a tour of the mines in New Jersey, for the purpose of seeing how much ore there was left in them and how long it would last. It was on this trip that he made the discovery that most of the rocks of New Jersey were underlaid with immense deposits of iron. He invented a magnetic needle which would dip towards the earth whenever it was brought over a large deposit of iron-ore. He was driving along in a buggy one day between two mines. The needle was on his lap and his mind was drifting away from the subject in hand when suddenly he noticed the point of the needle dip violently towards the earth, and remain pointing downwards. He wondered how this could be, for, as far as he knew, there was no iron-ore anywhere near him. He tested the needle and found it all right. He was driving over gneiss rock at the time, and he noticed that whenever he was above this rock the needle continued to point towards the earth. His amazement became great, for, if the needle did not err, it simply meant that the ground under him was underlaid with immense deposits of iron. Determining to find out if this was so, he set a corps of men at work making a magnetic survey of the rocks of New Jersey. As a result of this survey it was found that iron-ore, in a finely-divided state, existed in nearly all of the older rocks of New Jersey. He then planned a magnetic survey of the whole East, and it remains probably the most comprehensive undertaking of its kind ever accomplished.

With his magnetic needle, or, as he calls it, his "magnetic eye," he tested every large body of gneiss rock extending along the eastern coast of the United States, from lower Canada to the Smoky Mountains of North Carolina. He found immense deposits of iron. For instance, in the 3,000 acres immediately surrounding the Village of Edison there are over 200,000,000 tons of low-grade ore. In the entire district there are 16,000 acres in which the deposit is proportionately as large. The world's annual output of iron-ore does not, at the present time, reach 60,000,000 tons; so that in the two miles surrounding the Village of Edison he calculates there is enough iron-ore in the rocks to keep the whole world supplied for one year, or the United States for three years, even with the natural increase in demand. Sixteen thousand acres, or twenty-five square miles, of land contain enough iron-ore to keep the whole world supplied for seventeen years, allowing, of course, for all natural increase of demand, due to the needs of a growing population. These acres would more than supply the United States with iron, including necessary exports, for the next seventy years; and they contain more than has been mined heretofore in this country since its discovery.

This was a remarkable condition—smelting-works shutting down for want of iron-ore at low prices when billions of tons of it lay idle in a strip of land which in most cases was within seventy-five miles of the great iron-mills of the Atlantic coast. Here was an opportunity of which the inventor immediately took advantage. He set to work to plan out a great industry. It has taken him eight years to do it, but the result has justified all the trouble and money which he has expended upon it. Engineers used to large enterprises of the kind have smiled incredulously. Some of them have spoken of it as Edison's hobby, and others as his folly. Some have shown him on paper that no machine could be constructed powerful enough to crush 5-, 6-, and 7-ton rocks, or, if such a machine were constructed, it would never stand the jar and strain exerted upon it. This particular difficulty, it may be said, Edison claims to have surmounted so completely that less than 100-horse power is required to reduce rocks weighing 6 and 7 tons to dust in three seconds from the time they are thrown into the crushing-machine.

Yet, after all, he has accomplished a very simple thing. He is crushing rocks and dropping the resulting powder past powerful electro-magnets. The sand is not attracted by the magnetism, and passes straight on; the iron-ore is attracted to one side and falls in a heap of its own, as shown in the accompanying sketch from the pen of Mr. Edison. This is the whole principle, yet in the actual working out it becomes one of the most tremendous processes in the world. It is, after all, no small matter to crush the very vitals out of a mountain and then extract all the ore from the millions of tons of sand.

The Village of Edison stands on the summit of Mount Musconetcong, in northern New Jersey, 1,200 ft. above the sea, in the centre of a wilderness. On all sides are the roar and whistle of machinery, the roar of conveyors, general noise, and bustle. The workmen look like millers, so coated do their clothing become with the flying white particles, and every one wears a patent muzzle.

Big wheels revolve in the engine-house and big dynamos transmit heavy currents through overhead wires to the various points of the plant. Little narrow-gauge locomotives move about. A line of freight-cars runs through the place. To the right of the village lumbermen are cutting down trees and making the land ready for the steam-shovel, which is tearing away at the rocks half a mile distant. Further over, on a half-cleared section of land, a great stream of water rushes through a hose with mighty force from a hydraulic pump and washes the *débris* free from the rocks, somewhat after the fashion of a monitor in our California foothills. Steam-drills rattle and the boom of dynamite resounds when the rock is riven into boulders and laid on 5-ton skips or trays, to be transmitted to the crushing plant. The steam-shovel does the work of loading, and, as it has a capacity of lifting 10 tons of free rock a minute the local activity is tremendous. Flat cars carrying two skips each move along at lively speed. A long line of them is constantly leading up to the crushing point, where big electric cranes rid them of their load, and a little switching-engine pushes them around a loop and allows them to run down an incline into the cut again.

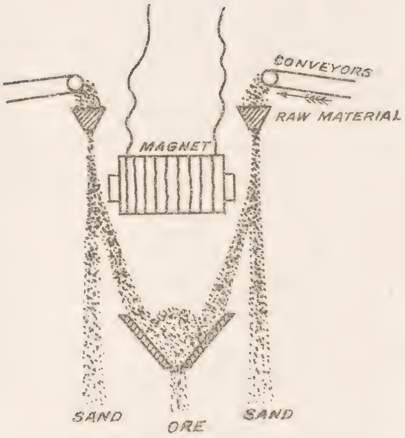
Edison says, "We are making a Yosemite of our own here. We will soon have one of the biggest artificial cañons in the world." This remark is occasioned by the fact that the steam-shovel is working three-quarters of a mile from the works proper. It is somewhat down the hillside, but it is eating its way on a level straight into the hill.

"It will take us a year to reach the hills, but when we do get that far in we will have a trench with walls 100 ft. deep. I suppose we will take out over 600,000 tons of rock before we get there. Then, when the trench is completed, we can blast off the walls with dynamite, taking off 32,000 tons at a time."

The ore-bearing rock is blasted into boulders, laid on flat cars with a steam-shovel, and conveyed to the crushing plant. The cars are run in under each end of the crushing-mill. The trays containing the rock are lifted by the cranes to the second story of the mill, where the rock is dumped into a large square pit.

Ten feet below is the crushing apparatus of two rollers 6 ft. in diameter and 5 ft. in width. The rounded surfaces are studded with great teeth; the rolls run within 18 in. of each other. These revolve with a surface speed of a mile a minute and weigh 237,000 lb. Beneath them is another set of rollers, nearer together, with a serrated surface. These rolls will receive and grind up 5- and 6-ton rocks as fast as they can be unloaded from the skips. A skip-load of rock every forty-five seconds was the ratio at which the plant was operated for the purpose of testing the capacity of the rolls, but an average of 300 tons an hour is considered a fair running-capacity.

The great Corliss engine which operates the rolls takes no direct part in the crushing process. It is the momentum of the 70 tons of metal contained in the moving parts of the rolls which does the crushing. The engine supplies just power enough to run the rolls at a very high speed. If anything drops in between the rolls so as in any way to impede their



Thos. A. Edison

progress a clutch, by which the rolls are connected to the engine, allows the latter to let go its hold. After the momentum of the rolls does its work the engine immediately catches hold again. Only the fastest train travels with the velocity of these rolls, and it is 70 tons of metal against 5 or 6 tons of rock. Again, the rock is dropped over 10 ft. before it strikes the rolls, and the impact on the rapidly-moving rolls is often enough to break the boulder in two. From the large rolls the rock is mechanically conveyed to one set after another until the last turns it out in dust. The friction of ordinary crushing-rolls at the high efficiency and pressure necessary for this work amounts, under ordinary conditions, to about 80 per cent. of the horse-power applied, leaving only 20 per cent. to do the actual work on the rock. On the three high rolls invented by Edison the friction is only 10 per cent., leaving 90 per cent. of the energy applied for the work of crushing. The principle involved means the beginning of a new era in crushing machinery. The principle can be applied in every industry where crushing is a feature—from gold-extracting to sugar-refining.

One of the features of the place is the great number of endless chain elevators which connect the buildings one with another. As the ore passes through each building it is carried on to the next automatically in these endless elevators. After it leaves the crushing plant it is carried to the top of the magnet-house and dumped through many sieves of varying meshes and past many magnet-faces of varying strength before it ultimately falls in the cellar of the building and into another elevator, which carries the greatly-changed product to the next department. There is over a mile of magnet-faces in the magnet-house. The ore drops down through long chutes. On the way down it passes the magnet-faces. Directly under each magnet-face is a side chute leading off in a direction of its own, and directly above each magnet-face is a sieve. As the ore comes down, if fine enough to pass through the sieve, it continues its course; if not, it rolls off the sieve into a chute, at the bottom of which there is a conveyor which carries it back to the rolls to be recrushed. If the product goes through the sieve, the magnet draws the ore from the sand, the sand passing straight down to an elevator, which carries it out of the building and dumps it on to a huge sand pile, which is not a useless accumulation; it is sold for various purposes to builders and manufacturers, who seek it more eagerly than they do the sand of the seashore or of the bank. Seashore or bank sand has, in the course of centuries, lost its edges, because the particles have constantly rubbed against one another. Broken rock sand, however, is very sharp, and for cement and lime-work is very desirable.

The pure ore is now allowed to drop downward and pass through a room where blowers rid it of any dust which may have accompanied it on its travel. After leaving the blower-room it is a stream of pure, finely-divided iron-ore, which drops into conveyors and is carried to a storehouse, which holds 5,000 tons. Here it may rest temporarily or it may pass on by means of other conveyors to the mixing-house. It cannot be smelted in the form of iron dust. The force of the blast would blow it from the furnaces. It must be made into briquettes, and to do this it must be mixed with some adhesive substance which will prevent it from disintegrating when brought under the action of the furnace. The mixing-machines are huge cylinders in which operate great iron paddles. The ore is fed into the cylinder from the top, and adhesive material drops from above, and the whole mass is churned together until every particle of the ore has come in contact with a due proportion of the adhesive substance. It becomes a sticky mass, which is pushed out of one end of the cylinder and conveyed away to the bricking-house to be made into little briquettes.

The ore drops into a small orifice in the cylinder. The cylinder then turns so that the hole comes forward and exerts thousands of pounds pressure on the ore; the cylinder then turns downward, and the newly-made briquette drops out from the hole and falls into another endless conveyor, and is carried forward into a large oven, to be baked. There are thirty bricking-machines and fifteen ovens in the plant, and a continual stream of briquettes are circulated through the hot-air chambers of these ovens. The conveyors travel five times around the interior of the oven before the briquettes reappear. When they come out they have undergone a change which makes them a commercial product. For instance, they will now absorb gases in the furnace, which they are required to do; but they will not absorb water. This condition is necessary so that they may be shipped to the furnaces in open cars. If a stream of water were allowed to flow on a brick the water would simply run off; on the other hand, if alcohol were dropped on it, it would instantly be absorbed by the brick.

From the oven the bricks are conveyed to the railroad, where long trains of freight-cars await them. The conveyor at this point extends out over the track, and the engineer of a train has simply to back his cars underneath the mouth of the conveyor. The bricks drop out and the cars load themselves. From the time the ore is blasted with its native rock out of the mountain side until it is loaded in the form of commercially pure iron briquettes on the cars it is not touched by human hands. The never-ending and never-resting stream of material constantly circulates through the various buildings, crushed by the stored momentum of gigantic rolls; hoisted skyward by steam; pulled earthward by gravity; deflected by magnetism; dried, sifted, weighed, gauged, conveyed; changed from rock into dust, and from dust into comprehensive lumps, mixed with a due proportion of adhesive material; churned, baked, counted, and sent flying to the furnaces by fast freight; and not once in its course is it arrested or jogged onward by human agency.

Only 145 attendants are required to operate the plant, and these men are after all merely watchers, to see that the machinery does not get out of order. Edison says that the crushing-capacity of the plant is more than 20 per cent. greater than the combined crushing-capacity of all the stamp-mills of California. The long mile of magnet-faces have enough pulling-power to tear a modern cannon from its stanchions, and the great steam-shovel can clean out more rock from the mountain side in a given time than any other like piece of mechanism in the world. Yet all these great affairs seem as nothing to the masterful control of the man who planned it all. Edison moves about among his men with not the slightest consciousness of having done anything great. He says it will be but a question of time when the little plant on the hilltop will be the centre of the great iron industry of the East. The pockets of ore from which the United States has drawn its chief supply are rapidly becoming exhausted. There is, it must be understood, plenty of iron-ore in the country, but it is not the kind of ore from which steel can be made. Steel can only be made from ores in which the percentage of phosphorus is very small. Edison, with his crushing process, has entirely eliminated the phosphorus element from the ore. It therefore remains inevitable that this must ultimately become the only serious method of producing ores from which steel will be made. It would seem from the prospect that Edison will become the head of a vast industry, as great as that brought into existence by the invention of the incandescent light, and in a measure more imposing, as it embraces the production of what in commercial circles is after all the most valuable metal on earth.

WATER-POWER POSSIBILITIES.

FAR-SEEING men all over the world are looking for substitutes for the coal which, as the source of steam-power and as a necessity in various metallurgical operations, lies at the basis of nearly all manufacturing enterprises. Coal is getting dearer everywhere, even in regions where, as in the greater part of the United States, no scarcity has yet been developed. With the rapid increase of consumption which follows an increase of population the day cannot be far off when scarcity will be felt even in what are now the most favoured regions. The yoking of the wind or the sun's rays to the chariot of industry occupies the thoughts of not a few. Ericsson taught us before he died that a caloric engine set in motion by the sun's rays was not an impossibility, and in the direction of power generated by thermo-electricity—the sun furnishing the heat—still more definite successes seem to lie. But it is in the greater development of natural water-power that the most practical men look for the readiest substitute for steam. Lord Kelvin, the eminent British scientist, said recently in a public address that he looked for such scientific and successful use of water-power that the industrial conditions of all Scotland would thereby be transformed. All classes and all parts of the country, he thought, would be profoundly affected. The localities where the "scientific and successful" development of water-power can be achieved at the smallest expense are those which will take the lead now held by localities most accessible to coal deposits. Such water-favoured localities, where natural power has been used in a wasteful way by old-fashioned methods, are studying how best to get the full value from the natural endowments of their sites by the use of more scientific methods. California is occupying a prominent place in utilising the unyoked water-power of mountain and valley in producing electric power and light, and thus creating a new industrial era.

As in California, so elsewhere in this west half of America, great electrical plans are fast being put in tangible shape. A site has recently been selected for the proposed dam on the Big Hole River, Montana, at which point will be erected a $500,000 electrical generating plant to transmit current to Butte, Montana. It is expected that the plant will be completed by February, 1898. The power-house will be 212 ft. long, with a steel smokestack 150 ft. in height. The dam on the Big Hole River, four miles from the divide, will be 60 ft. high, built of masonry. The penstocks will be 10 ft. in diameter. It is expected to transmit 5,000-horse power to Butte at an approximate loss of 10 per cent. in transmission.

Those who are developing the natural resources of this coast—Central and South America—readily see the uses to which water-power can be put in the generation of electricity. Coal is expensive in these latitudes and makes the cost of supplying power by means of steam greater than that of utilising water. Of the output of one electric company, 40 per cent. of that which goes to the countries south of us is for use in connection with water-power. In most instances the power generated is used on the spot, long transmission being rare. Among the cities which use electricity derived from water-fall are Escuintla, Guatemala; San Salvador; San Miguel and Chihuahua, Mexico; San Gil, Colombia, and San Christobal, Venezuela.

The Electric Power Transmission Company at Pachuca, Mexico, develops 3,300-horse power and transmits it nineteen miles for power—mining and light. The San Rafael paper-mills at Ameca, Mexico, get 750-horse power; and for Puebla, Mexico, the Puebla Lighting Company generates 965-horse power and sends it nine miles to the city.

One electric company is constructing for the Jalapa Electric Light Company a plant which develops 800-horse power and carries it eight miles to Jalapa. The same company has installed a 400-horse-power plant for the Mazipal Copper Company of Conception del Oro, Mexico. The line is seven miles long. The Compania de Alumbrado Electrico of San Salvador gets 320-horse power from a point seven miles distant. Percy Burbank generates 150-horse power five miles from Lima, Peru, and sends it into that city for light and power. In the Argentine Republic the Cordova Light and Power Company develops 5,000-horse power and sends it sixteen miles into the City of Cordova.

European countries do not seem to have taken hold of the generation of electricity by water-power with the energy the New World has shown. Up to 1894 the largest amount of power produced electrically from water-flow was 3,000-horse power, generated at the Falls of Tivoli, Italy, and transmitted seventeen miles to light Rome.

Work at Rhinefelden, on the upper Rhine, is going on; 15,000-horse power will be developed by means of twenty turbines. 10,000-horse power will be used in electric chemical industries, and the rest in lighting.—*Mining and Scientific Press* (San Francisco).

At a meeting of the Liverpool Geological Association, the president (Mr. G. A. Haworth) gave an interesting address on "Faults met with in Mining." He pointed out the advantages and disadvantages of "faults" in coal-mining districts, showing how they in many cases brought the coal from unworkable depths to the surface, and the assistance they gave in the drainage of mines. It was pointed out, on the other hand, that they often caused mines to be flooded, an illustration being given of the case of a Wigan mine, in which a new sinking had penetrated a "fault" producing 180,000 gallons of water per hour. The lecturer illustrated his address with numerous explanatory drawings, showing different kinds of "faults" and the methods adopted when met with of discovering the continuity of the coal-seams which they displaced. Mr. Haworth exhibited stalactites of salt from the roof of a coal-mine, nodules of pyrites, and specimens of ferro-manganese.—*Mining Engineering.*

J. J. Stafford, foreman of the Champion Reef Gold-mine, Mysore, India, was sentenced to three months' rigorous imprisonment for stealing a gold "button" from the cyanide works of the mine. Ramachandra Chetty, a native usurer, was sentenced to twenty-five stripes for receiving the gold, knowing it to have been stolen.

Mr. J. K. Gulland, London, is to supply the Mines and Water-supply Department, Victoria, with sixty carbons, weighing 228⅝ carats, and twenty-one ballas, weighing 43¼ carats, at the rate of £5 10s. per carat = £1,495 6s. 3d.; also 140 carbons weighing 481⅞ carats, at £6 per carat = £2,891 5s.

Cyanide has resulted in a large increase of the gold yield at Charters Towers, Queensland. During the first ten months of the past year 168,764 tons of tailings, treated by cyanide, yielded 76,749 oz. of gold, valued at £115,123.

Boston shareholders are said to own most of the copper-mines in Canada and the United States. The last few months of the year showed remarkable ups and downs in some of the copper stocks on the Boston Stock Exchange, while the price of the metal varied very slightly.

According to a Consular report, the demand for coal and coke in Mexico is becoming greater each year, in view of the increasing scarcity of fuel and the remarkable development of industrial enterprise throughout that country.

In a self-igniting arrangement for miners' safety-lamps devised by Herr H. Freise, of Hamme, near Bochom, Westphalia, the pricker, besides its usual end being turned at right angles, is fitted a little lower down with a small plate, the two sides of which have toothed edges. When the lamp is completely closed and locked one of these toothed edges can regulate the wick, and by giving the pricker half a turn the toothed edge on the other side of the plate can raise the igniting band to a striking surface mounted on a spring, so as to bring about the ignition, while by a simple turning of the pricker the wick may be trimmed by the small plate and the upper end of the igniting band can be cleaned by the horizontal end. Instead of the friction surface for ignition, one for igniting by percussion, also mounted on a spring, may be substituted, being provided with several slits to permit the insertion of the pricker end for drawing out the spring, by a recoil of which the percussion is effected.

MINING PUBLICATIONS.

THE following works, published under the authority of the Government, are now on sale at the Government Stationery Department, Wellington, and will be transmitted post-free at the published price to any address in the colony, or to any place within a British possession :—

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EXAMINATION FOR MINE-MANAGERS' AND BATTERY-SUPERINTENDENTS' CERTIFICATES.

Mines Department,
Wellington, 3rd November, 1897.

AN Examination of Candidates for Certificates as First- and Second-class Mine-managers and Battery-superintendents, under "The Mining Act, 1891," and Amendment Act, 1894, and First- and Second-class Mine-managers under "The Coal-mines Act, 1891," will be held on Tuesday, the 25th January, 1898, and three following days.

T. H. HAMER,
Secretary to the Board of Examiners.

THE NEW ZEALAND MINES RECORD.

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